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## Tuberculosis Studies in Muscogee County, Georgia <sup>1</sup>

### I. Community-wide Tuberculosis Research

By GEORGE W. COMSTOCK, *Surgeon* <sup>2</sup>

The Muscogee County Health Department, assisted by the Georgia Department of Public Health and the United States Public Health Service, in 1946, undertook to establish in a community of about 100,000 people a cooperative facility with the principal purpose of combining effective tuberculosis control and a broad basic epidemiological study of tuberculosis. The essential difference between this endeavor and the activities of the usual health department is that in the former a service program is integrated with research.

The behavior of a disease in an individual patient is usually described in terms of the abnormalities it causes; this presupposes a knowledge of what is normal for that patient. If the behavior of a disease in a community is to be described intelligently, a description of the total population is necessary with as much emphasis on the normal members of that community as upon those affected by the disease. For, if any illness is to be understood and finally prevented, enough must be known about the population from which the disease arises so that we may eventually learn the characteristics of those who succumb to it. Only when these characteristics are known can we hope to change them in such a way that the disease will no longer occur.

In tuberculosis, the average health department concentrates on the persons with abnormalities and gives them service. Those with the greatest abnormalities are given the most service. Epidemiological research, on the other hand, must consider not only those apparently in need of service but must give attention to all persons within the study area. It must take into account not only the people who have been examined, but those who have not been examined. It must concern itself with the normal as well as the abnormal, and—among

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the abnormal group—with slight as well as gross anomalies. Such a research program must pay attention to the entire community.

Accordingly, extensive epidemiological investigations are not undertaken by the average health department which under ordinary circumstances can do only extremely limited research. However, with attention not only to the sick but to those persons without demonstrable pathology, many service programs could add to our knowledge about the development of disease. The experience of the Muscogee County tuberculosis study illustrates how an extensive research program can be closely woven into the usual health department services in tuberculosis control.

The purpose of the Muscogee Study was to gain as complete a knowledge as possible of the community so that all factors which influence the spread of tuberculosis could be evaluated. One requisite for a study of this kind is a census and a collection of other basic information concerning the total population. In Muscogee County a special census was made in 1946, and, in addition to the usual census data, several items of information on housing were gathered. These items were used as an index of socioeconomic forces. Additions and deletions of birth and death records help to keep the census up to date.

To obtain information about the tuberculosis experience of as many persons as possible, a community-wide chest X-ray survey was made and tuberculin tests were given to all school children. These projects yielded basic data about both the examined and unexamined groups, and, for the examined, information about both the normal and the abnormal.

X-ray examinations in the local health department clinic have been greatly expanded so that approximately one-sixth of the entire population is X-rayed each year. The follow-up program is intensive—persons with even slight abnormalities are followed as carefully as those with major pathology. Future community X-ray surveys and tuberculin surveys are planned to keep all the information current.

The problem of combining the mass of data into usable form was solved to a considerable degree by the use of a master index file. In this file each individual known to be in the community has a separate card, which reveals in both visible and punch-card form, his identification data, housing conditions, tuberculin sensitivity, contact history and the results of all chest X-ray examinations.

As soon as enough information has been accumulated many epidemiological problems can be attacked. The mass survey, continued case-finding procedures, and repetition of the mass survey at intervals will yield invaluable data about the large number of people who were considered normal in the first survey. The future histories of these people will reveal the incidence of tuberculosis in a sizable population, and it should be easy to discover the source of infection for newly

developed cases among this group because of the limited time between examinations. These procedures should clarify to some extent the pattern of infection and should also help us to determine an optimum interval between mass surveys.

An evaluation of the mass X-ray survey as a method of case finding is needed. Few persons would now affirm that the method is without value, but we do not yet have a definite measure of its worth. In Muscogee County an effort has been made to evaluate the survey in terms of what percentage of the population it reached and which groups in the population responded best. This information has been correlated with social data—economic indices, age, sex, race—and the results of the correlation are presented in the second paper of this series which is included in this issue. An even more searching evaluation will be possible when enough time has elapsed to correlate the carefully collected data with the new cases which are discovered in both the previously examined and unexamined groups.

The case-finding survey should also be compared with other methods of discovering new cases if its effectiveness is to be known. In addition to mass X-rays, Muscogee County health administrators have continued to use the classical methods of control—contact investigations, tuberculin studies, examination of contacts of tuberculin-positive children, and clinic examinations. A comparison of methods, therefore, is possible. Little is to be gained from a comparison of the initial findings. Proof will lie in the subsequent history of people discovered by the different methods to have tuberculosis and, more importantly, in the subsequent history of their contacts. These data are being collected in the Muscogee County Study and will become available for analysis as soon as enough time has passed to make them significant. Coincidentally, similar studies can be made of the history of persons found by mass X-ray programs to have non-tuberculous chest diseases.

Certain refinements in mass survey techniques may also be evaluated. One of these is the practice of having survey films read independently by two different readers. The initial benefits of this technique have already been described,<sup>3</sup> and the value of the procedure in terms of subsequent morbidity and mortality rates can be determined within the framework of the Muscogee Study. Methods of obtaining follow-up from the mass surveys are also being studied. It is expected that the systematic collection of data, with methods suitably controlled, will help answer the problems about survey follow-up that are constantly arising.

Information from the mass survey need not be restricted to use in the field of tuberculosis control. A large survey in many respects is

<sup>3</sup> Birkelo et al: Tuberculosis Case Finding: A comparison of the effectiveness of various roentgenographic and photofluorographic methods. *J. A. M. A.* 133: 359-365 (1947).

a partial enumeration of the population, and comparison between the persons listed in the Muscogee County survey and in the census provide a check on the accuracy of the census, as well as on the coverage of the survey. A future survey, if largely successful and properly analyzed, will reveal the movements of population groups in this community.

Tuberculin studies in the schools and a projected tuberculin survey of the entire community should strengthen and clarify much of our investigational work. The value of tuberculin testing as a case-finding technique and the patterns of tuberculin sensitivity in the county may be discovered. Closely related is BCG vaccination, which has been offered to Muscogee County school children under controlled circumstances. Although the number vaccinated was small, results should yield significant conclusions because of the detailed knowledge available about both the vaccinated and the control groups.

For a long time it has been felt that socioeconomic factors have great influence on the development of tuberculosis, the fate of infected persons, and the readiness with which patients accept treatment. Lack of knowledge about the normal group, as well as the restriction of many socioeconomic studies to selected population groups, has prevented an adequate determination of the role of these factors both in the development of the disease and in the behavior of tuberculous patients. The information obtainable through a broad research facility which is almost indistinguishable in many respects from a service program can readily be used to answer basic sociological questions in tuberculosis.

Other fundamental problems to which such data can be applied include the familial aspects of tuberculosis, and the effect of the disease on the fertility of families.

Without comprehensive planning and close attention to epidemiological principles the research value of the Muscogee Study would have been limited. That it promises to shed some light on the behavior of tuberculosis in addition to rendering service to the community is, perhaps, also related to the composition of its staff. There are more workers than is usual in a chest clinic. A full-time statistician is assigned to the study, and the over-all planning and execution has been under the direction of an epidemiologist who has given the necessary research outlook to what might otherwise have been only an intensive service program.

Anyone who has had personal experience with large-scale epidemiology will quickly realize that the problems presented in this paper are so great that no one group, even supported and assisted by several large agencies, can hope to attack and solve all of them. This study is the work of many cooperative agencies, and could hardly have achieved its solid foundation in the community without their

active assistance. It is likely that more cooperation will lead to progressively greater realization of the potentialities of this work.

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The Muscogee County Tuberculosis Study was due almost entirely in its conception and early execution to the broad vision and vigorous stimulation of Dr. J. Yerushalmy, formerly Principal Statistician, Field Studies Branch, Division of Tuberculosis, Public Health Service, and presently Professor of Biostatistics, School of Public Health, University of California.

It is impossible to assign exact degrees of participation in this research facility to all the cooperating organizations. We are deeply grateful, however, for the assistance given by the following groups:

Alabama Department of Public Health; Bureau of the Census, Department of Commerce; Columbus Board of Education; Columbus City Commission; Columbus Housing Authority; Division of Tuberculosis, Public Health Service; Division of Venereal Disease, Public Health Service.

Family Service Bureau, Columbus, Ga.; Georgia Department of Education, Division of Vocational Rehabilitation; Georgia Department of Public Health; Georgia Tuberculosis Association; Industrial Nurses' Association, Columbus, Ga.; Junior Chamber of Commerce, Columbus, Ga.; Junior League, Columbus, Ga.

The Muscogee County Board of Education, Commissioners of Roads and Revenue, Department of Public Welfare, Health Department, Medical Society, and Tuberculosis Association; Parent-Teacher Association, Columbus, Ga.; Russell County Health Department, Phenix City, Ala.

## **Tuberculosis Studies in Muscogee County, Georgia**

### **II. X-Ray Findings in a Community-wide Survey and Its Coverage as Determined by a Population Census <sup>1</sup>**

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For many years mass radiography of apparently healthy persons was limited to special groups. Because chest X-rays were expensive and more tuberculosis could be expected in some groups than in others, X-rays were made primarily of contacts of known cases of tuberculosis, positive tuberculin reactors, and sometimes the contacts of positive tuberculin reactors.

With the introduction of photofluorography, however, it became economically possible to examine groups of people among whom there was no reason to suspect an unusual prevalence of tuberculosis. In-

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dustrial employees were easy to reach, and they were one of the first apparently healthy groups surveyed. People in mental hospitals, a few general hospitals, prisons and schools were included in the earlier surveys. During World War II, routine chest X-rays were included in both the induction and discharge examinations of members of the armed forces.

In the present community-wide surveys some units go to industries, others to schools, and still others to those heterogenous parts of the population which are not accessible as groups. The units are placed in convenient neighborhood locations or in business sections to reach all the people in the community.

The community-wide chest X-ray survey has been widely accepted as a practical and effective method of tuberculosis control. But the effectiveness of such a survey depends upon its completeness, on the isolation and care of infectious cases, and on the provision for adequate follow-up of the noninfectious cases.

Little information has been available about the exact coverage of community-wide surveys or about the population groups reached. A few surveys have been preceded or accompanied by a house-to-house canvass or census which served two purposes—to tell the people about the opportunities of the survey and to provide such a knowledge of the community that during or after the survey, it would be possible to know who had and who had not been examined. This procedure in this country has apparently been limited to small communities and the coverage has been excellent (1).

The community-wide survey in Muscogee County, Ga., was followed closely by a population census and a housing survey. Thus it has become possible, by combining the data collected in both the survey and census, to measure the completeness of an X-ray survey in various population groups in a county of approximately 100,000 population. Both the radiological and demographic characteristics of the examined population can be described. The census data also give us knowledge of certain characteristics of the unexamined population, which as far as we know has not been obtained previously in a group of this size.

The first large community-wide survey, carried on in Savannah, Ga., in October 1945, was a joint venereal disease-tuberculosis program in which each person was offered a blood test and a chest X-ray. It was estimated that approximately 65 percent of the population over 15 years of age was reached in this undertaking. Muscogee County, Ga., was the location of a second similar program in May and June of 1946. Cooperating on the project were the City-County Health Department, the Georgia State Health Department, the Public Health Service and the State and local Tuberculosis Associations.

## Description of Survey

The Muscogee County survey was conducted for 6 weeks during May and June 1946. Every person in Columbus, Ga., and the surrounding county who was over 12 years of age was offered a blood test and a chest X-ray. Continuous publicity throughout the period of the survey included newspaper stories, radio announcements, 6-foot posters on downtown lamp-posts, club announcements, leaflets enclosed in mailing lists, and sound-truck publicity on the streets. There was no house-to-house educational and publicity program.

Six units were used to take 70 millimeter photofluorograms. Three remained in the same locations throughout the survey. The unit at the City-County Health Center was used as a station for both white and Negro persons. Another unit in a downtown shopping location was open to the white population only, and a third in a Negro shopping center was for Negroes only. One unit, used almost exclusively in factories, was moved every few days to a new location. Another unit open to the general public moved to various neighborhoods in the course of the survey. A sixth unit covered the junior and senior high schools and some neighborhood areas.

Chest X-rays were made of 51,940 persons, of whom 46,743 gave Muscogee County addresses. An additional 3,278 persons, mostly Negro school children, received blood tests but no X-rays. Most of the remainder X-rayed came from Phenix City, Ala., a part of metropolitan Columbus, just across the State border. Since many residents of Phenix City and Russell County, Alabama, are employed in the mills and factories of Columbus, and since the existence of the State line does not separate the activities of these two adjacent counties, it seemed advisable to survey Russell County as well. Therefore, at the end of the Muscogee County survey, three of the X-ray units moved to Russell County and in 2 weeks X-rayed 9,500 people there. These additional examinations, while useful in the tuberculosis control program, are not included in this report.

All the 70 mm. films in the Muscogee County survey were read independently by two chest physicians (2). Any person whose film was read as "tuberculosis" or "suspected tuberculosis" by one or both readers was recalled for a 14" x 17" film at the City-County Health Center. Most of these follow-up films were taken between May and September 1946.<sup>5</sup> Seventy millimeter "recalls" who did not respond to the recall letters were later visited in their homes and the initial large films were taken after September. By July 1, 1948, 86 percent of the 70 mm. suspects had had 14" x 17" films. These were also interpreted by two readers. If the 14" x 17" film was read as "tuberculosis" or "suspected tuberculosis" by either reader, the

<sup>5</sup> The response to the various follow-up techniques will be reported in a later paper.

patient was placed in the "to be followed" group, to be X-rayed at least once every 3 months.

Later in this paper, in the determination and discussion of prevalence rates, "tuberculosis" will include all cases of reinfection tuberculosis, active or questionably active primary tuberculosis, pleurisy with effusion, and all persons whose initial 14" x 17" chest films were thought to be suspicious of tuberculosis.

### Description of Census

A necessary technique in the establishment of a research facility for the study of the community-wide epidemiology of tuberculosis is an enumeration of the population. The census becomes the base line data, the denominator, for the study program. Accordingly, a census was conducted in Muscogee County in September 1946.

To determine what groups of the population the survey reached and to discover the prevalence of tuberculosis in these groups this special census of the population was invaluable. Also, since in practice the goal of a 100 percent coverage of a county of 100,000 people was not attained, the census identified the individuals who lived in the county but were not X-rayed. The census and survey together described the population; the groups X-rayed and those not X-rayed.

In most of the larger community-wide surveys, estimates have been made of the coverage of the population by age, race and sex. However, estimates of population are unreliable because of the long interval since the 1940 census and the great movement of the population during and since the war.

The September 1946 enumeration was not an official census according to the U. S. Census Bureau. If a census is conducted by this agency, the record of each individual is considered to be confidential and is not available for use by other agencies. Since it was necessary for the research program to identify the individual, the census was carried on by personnel of the Muscogee County Tuberculosis Study with consultative service from the Bureau of the Census. A household schedule was used to obtain the name, address, race, sex, marital status and relationship to the head of the household of each person. It also included a few simple questions on housing. Addresses were checked with all available directories to make sure the census taker had located each known address. In each enumeration district, a spot check was made in which 5 percent of the households were reenumerated. These checks indicated very little under-enumeration. (See figure 5, page 276.)

The enumerated population of the county was 95,638, of which 28,706 or 30 percent were Negro. Muscogee County has only one city, Columbus. Within the 1946 city limits—an area of 6½ square

miles—there were 57,000 persons. If the urban area which was then outside the city limits but was annexed in January 1949, is included, the population of the city becomes close to 75,000. There are a few densely populated subsections in the rest of the county but most of the areas are rural. The entire county, exclusive of a military reservation, covers an area of approximately 130 square miles. It is bounded on the west by the Chattahoochee River, which forms a State boundary. Directly across the river is Russell County, Ala., with Phenix City as its county seat. In 1948, Phenix City had a population of 22,187. It is included in metropolitan Columbus. On the south and east is the Fort Benning reservation, a large army post. The counties on the north and northeast are rural and there is no large city nearby.

At the end of the census period, the survey and census records were arranged by address and matched. The records were more easily matched by address than by name because there were frequent discrepancies in the spelling of names. Those unmatched were then rearranged alphabetically and a second attempt was made to match them. The records for households or individuals who had moved during the 3-month interval between the survey and the census could be matched only in this way. Because of the appreciable interval between the survey and the census many problems arose. Columbus is an industrial city and is adjacent to an Army post. There are many changes in population from moves within the county, and in and out of the county. After every effort had been made, 19 percent of the survey records still could not be matched with a census record. The person with only an unmatched survey record may have moved from the county in the intervening 3 months, he may have been missed in the census, or he may still have been in the county and have been enumerated in the census but because of differences in addresses or in the spelling of names his two records could not be brought together. However, a field investigation of a sample of the unmatched survey records revealed that probably there was but little underenumeration and that many people had actually moved from the county.

### Survey Coverage by Age, Race and Sex

The percent of the population covered by the survey is shown by age, race, and sex in table 1 and figure 1, which are based on an assumption that the census population in September was representative of the population at the time of the survey in May and June and that all those surveyed who used Muscogee County addresses came from this population. The assumption implies that the number of persons who moved out of the county in the interval between the survey and census equalled the number who moved into the county in the same interval. Generally, X-rays were offered only to those over 12

**Table 1. Number and percent of census population examined in community-wide survey by age, race and sex; Muscogee County, Ga., 1946**

Age	Total			White male			White female		
	Population	Number surveyed	Percent surveyed	Population	Number surveyed	Percent surveyed	Population	Number surveyed	Percent surveyed
Under 5 yrs.....	10,470	61	0.6	3,989	17	0.4	3,791	15	0.4
5-9.....	8,070	1,639	20	2,822	80	3	2,661	95	4
10-14.....	7,447	4,863	65	2,345	1,040	44	2,440	1,148	47
15-19.....	7,480	6,202	83	2,094	1,453	68	2,886	2,117	73
20-24.....	10,118	6,135	61	2,884	1,094	38	4,232	2,162	51
25-34.....	19,412	12,054	62	6,761	2,936	43	7,085	3,962	56
35-44.....	14,376	9,654	67	4,930	2,546	52	4,966	3,023	61
45-54.....	9,025	5,637	62	3,044	1,634	54	3,238	1,659	51
55-64.....	5,124	2,568	50	1,752	847	48	2,056	797	39
65-74.....	2,937	1,003	34	900	326	36	1,191	257	22
75 and over.....	1,037	180	17	276	63	23	460	28	6
Not stated.....	142	25	-----	51	4	-----	64	6	-----
Total.....	95,638	50,021	52	31,848	12,020	38	35,070	15,269	44
Total over 15 years.....	69,651	43,458	62	22,692	10,883	48	26,178	14,011	54

Age	Negro male			Negro female			Sex or color not stated	
	Population	Number surveyed	Percent surveyed	Population	Number surveyed	Percent surveyed	Population	Number surveyed
Under 5 yrs.....	1,335	13	1	1,352	16	1	3	-----
5-9.....	1,256	706	56	1,331	756	57	-----	2
10-14.....	1,332	1,328	100	1,330	1,343	101	-----	4
15-19.....	1,047	1,139	109	1,453	1,510	104	-----	3
20-24.....	1,175	1,100	94	1,826	1,779	97	1	-----
25-34.....	2,398	2,173	91	3,162	2,983	94	6	-----
35-44.....	2,002	1,897	95	2,478	2,188	88	-----	-----
45-54.....	1,249	1,125	90	1,493	1,219	82	1	-----
55-64.....	565	447	79	751	477	64	-----	-----
65-74.....	367	211	57	477	209	44	2	-----
75 and over.....	109	48	44	191	40	21	1	1
Not stated.....	11	5	-----	16	10	-----	-----	-----
Total.....	12,846	10,192	79	15,860	12,530	79	14	10
Total over 15 years.....	8,923	8,145	91	11,847	10,415	88	11	4

years of age. Negro children in elementary schools were given blood tests but were not X-rayed. They are included as "surveyed," and therefore the number of "surveyed" exceeds the number X-rayed. Any person whose 70 mm. film was unsatisfactory and who did not return for a retake has been considered "surveyed" but not X-rayed. Of the total population over 15 years of age, 62 percent was reached by the survey. The coverage was very different in the white and Negro populations. Only 51 percent of the white population over 15 years of age was surveyed, but 89 percent of the Negro population over 15 years was reached.

In the white population, the age restriction accounts for the relatively low proportion of children surveyed in the 10-14-year age group and for the increase, in the 15-19-year age group, to 68 percent for males and 73 percent for females. In the 20-24-year age group there is a drop in the percent of white males and females surveyed to 38 and

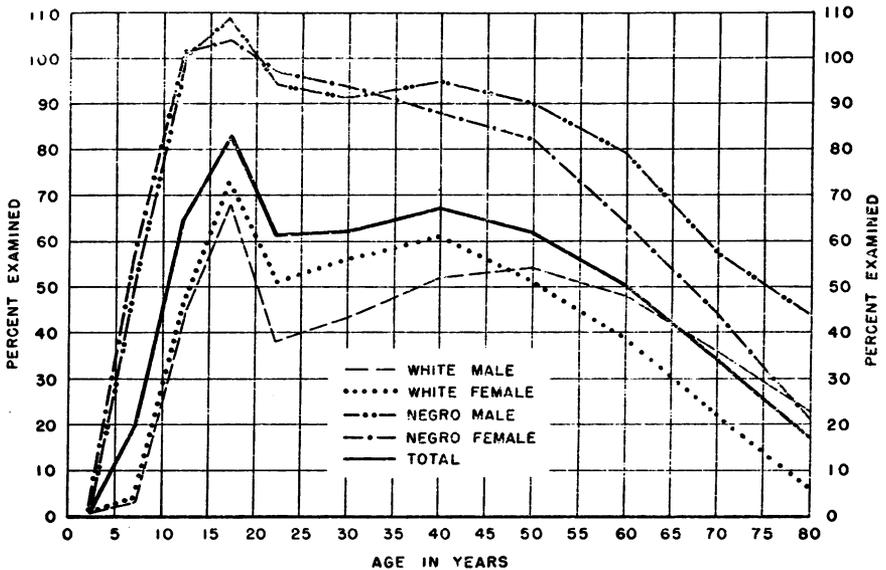


Figure 1. Percent of population examined in community-wide survey by age, race, and sex; Muscogee County, Ga., 1946.

51, respectively. It is in the 35-44-year age group that a second peak is reached for white females with 61 percent X-rayed; and it is in the 45-54-year age group that the second peak of 54 percent for white males is reached. After these peaks, as might be expected, the percentage X-rayed falls off steadily with increasing age. Relatively more white men over 45 were X-rayed than white women. The oldest groups were less likely to be reached by industrial survey units and the oldest white females were even less likely to be reached by such units. The poor response among white males aged 20 through 34 may be due to the fact that many had been recently discharged from the armed forces with a discharge X-ray and did not feel the need for another examination. On the other hand, there is a depression in the curve for white females in the same age group, which cannot be explained by the same reason.

The percent of the Negro race surveyed was higher in each age group than in the corresponding age group among white persons. The curve of percentages starts to rise earlier because of the blood testing program in Negro elementary schools. In the 10-14-year age group the percentages surveyed reached 100 and 101 in the males and females respectively; in the 15-19-year-age group the percentages were as high as 109 in the males and 104 in the females.

These percentages may indicate an under-enumeration of the population in the census or an over-enumeration in the survey. Both factors actually existed. Phenix City residents may have given a Muscogee County address, believing it necessary in order to have an

X-ray. It has been observed that Negroes are likely to move about frequently, both in and out of the county and within the county. Some may have had two survey records with different addresses or different names, and only one could be matched with a census record. The number missed in the census was probably greater in Negro households, since families are larger in size and the children frequently live with different relatives at different times. These reasons may account for the unduly high percentages.

For Negro women over 20, the percent surveyed falls off slowly to 82 among those 45-54 years, and more rapidly after that. In the group over 75 years of age only 21 percent were X-rayed. Among the Negro males, a slight drop, not nearly as marked as that observed among white males and females, appears from 20 through 34 years of age. Ninety-five percent were X-rayed in the age group 35 to 44, and following that the percentages decreased with increasing age. But even so, 44 percent of the Negro males over 75 years of age were X-rayed.

Table 2. Number and percent of census records matched with survey records by age, race, and sex; Muscogee County, Ga., 1946

Age	Total			White male			White female		
	Population	Number matched	Percent matched	Population	Number matched	Percent matched	Population	Number matched	Percent matched
Under 5 years.....	10,470	47	0.4	3,989	14	0.4	3,791	13	0.3
5-9.....	8,070	1,264	16	2,822	67	2	2,661	82	3
10-14.....	7,447	4,077	55	2,345	902	38	2,440	1,014	42
15-19.....	7,480	4,602	62	2,094	1,167	56	2,886	1,547	54
20-24.....	10,118	4,345	43	2,884	785	27	4,232	1,573	37
25-34.....	19,412	9,583	49	6,761	2,316	34	7,085	3,259	46
35-44.....	14,376	8,324	58	4,030	2,223	45	4,966	2,664	54
45-54.....	9,025	4,925	55	3,044	1,432	47	3,238	1,494	46
55-64.....	5,124	2,229	44	1,752	718	41	2,056	710	35
65-74.....	2,937	869	30	900	278	31	1,191	226	19
75 and over.....	1,037	151	15	276	54	20	460	23	5
Not stated.....	142	19	-----	51	4	-----	64	6	-----
Total.....	95,638	40,435	42	31,848	9,970	31	35,070	12,611	36
Total over 15 years.....	69,651	35,047	50	22,692	8,987	40	26,178	11,502	44

Age	Negro male			Negro female			Sex or color not stated	
	Population	Number matched	Percent matched	Population	Number matched	Percent matched	Population	Number matched
Under 5 years.....	1,335	10	0.7	1,352	10	0.7	3	-----
5-9.....	1,256	540	43	1,331	575	43	-----	-----
10-14.....	1,332	1,068	80	1,330	1,093	82	-----	-----
15-19.....	1,047	815	78	1,453	1,073	74	-----	-----
20-24.....	1,175	750	64	1,826	1,237	68	1	-----
25-34.....	2,398	1,649	69	3,162	2,359	75	6	-----
35-44.....	2,002	1,532	77	2,478	1,895	76	-----	-----
45-54.....	1,249	923	74	1,493	1,076	72	1	-----
55-64.....	565	371	66	751	430	57	-----	-----
65-74.....	367	182	50	477	183	38	2	-----
75 and over.....	109	39	36	191	34	18	1	1
Not stated.....	11	2	-----	16	7	-----	-----	-----
Total.....	12,846	7,881	61	15,860	9,972	63	14	1
Total over 15 years.....	8,923	6,263	70	11,847	8,294	70	11	1

The preceding figures are based on the assumption that a census population was the base population for the survey and that all those whose survey records had Muscogee County addresses actually represented persons examined. However, as a starting point for the longer epidemiological study in Muscogee County, it may be worth while to consider only survey records matched with census records in order to determine the portion of the September census population already examined. This will identify more precisely the X-rayed and the non-X-rayed. It is realized that newcomers to the county in the interval between survey and census did not have an opportunity to accept survey examinations. But nevertheless, they must still be

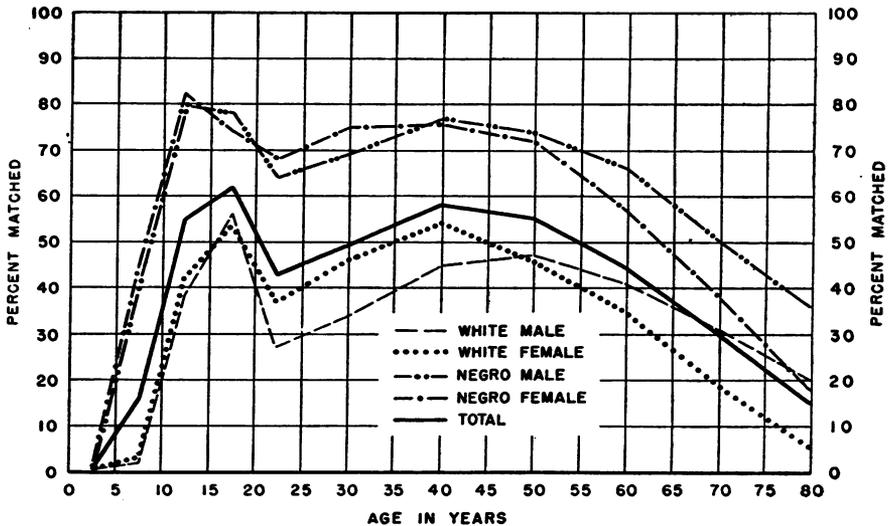


Figure 2. Percent of census records matched with survey records by age, race, and sex; Muscogee County, Ga., 1946.

included in the unexamined group as far as our knowledge of the county is concerned. The known coverage of this census population over 15 years of age then becomes 50 percent.

This figure is 42 percent for whites and 70 percent for Negroes, and represents a decrease from table 1 of 9 percent in the white coverage and 19 percent in the Negro. The difference represents those who have moved, those whose records could not be matched because of differences in name and address, and those who were not enumerated in the census. Table 2 gives the census population, the census population known to be surveyed and the percent known to be surveyed by age, race, and sex. In all four race and sex groups the 20-34 age groups show a smaller percent surveyed than in the immediately preceding or following groups. This depression is more pronounced than that in figure 1 and indicates that the young adult population is less stationary. A low point of 27 percent X-rayed was reached in

the 20-24 age group in white males. The percentage curves for Negro and white groups follow each other more closely in age trends when only matched records are used (fig. 2).

### Survey Response by District

It is possible that the response to a mass survey program may be different in various socioeconomic groups. To test this possibility, Muscogee County has been divided into 12 large districts by combining adjoining small enumeration districts which are as comparable as possible in percentages of white and Negro population, rents, and the general condition of the housing units. It is impossible to obtain strictly homogeneous districts, since the lack of zoning ordinances has allowed many of the enumeration districts to become quite variegated in their characteristics, often with opposite extremes in the same enumeration area. However, these 12 districts are, within their individual boundaries, as intrinsically uniform as possible, and conform closely to the popular, if unofficial, subdivisions of the county.

#### White Population

Table 3 shows the white population over 15 years of age in each district and the number and percent known to have been surveyed by sex.

**Table 3. Number and percent of white census population over 15 years of age, matched with survey records by district and by sex; Muscogee County, Ga., 1946**

District	Total			Male			Female		
	Population	Number matched	Percent matched	Population	Number matched with survey	Percent matched	Population	Number matched with survey	Percent matched
I.....	2,568	1,602	62	1,193	758	64	1,375	844	61
II.....	5,810	3,340	57	2,746	1,513	55	3,064	1,827	60
III.....	4,935	2,737	55	2,271	1,214	53	2,664	1,523	57
IV.....	5,371	2,261	42	2,452	1,033	42	2,919	1,228	42
V.....	4,621	2,198	48	2,043	903	44	2,578	1,295	50
VI.....	4,482	1,404	31	2,027	542	27	2,455	862	35
VII.....									
VIII.....	2,033	682	34	937	269	29	1,096	413	38
IX.....	3,248	1,013	31	1,559	430	28	1,689	583	35
X.....	6,467	2,269	35	2,955	1,029	35	3,512	1,240	35
XI.....	2,273	485	21	1,093	140	13	1,180	345	29
XII.....	7,041	2,485	35	3,409	1,151	34	3,632	1,334	37
Not stated.....	21	13		7	5		14	8	
Total.....	48,870	20,489	42	22,692	8,987	40	26,178	11,502	44

Only matched survey records were used. Figure 3, a map of Columbus and its immediate environs, shows by district the percent of the population matched with a survey record. District I, which is almost exclusively a white housing project owned and maintained by one of the local industries, has good housing and the lowest rents in the county. A higher percent of people were surveyed in this district than in any other; 62 percent were known to have responded. Neighboring dis-

districts II and III were next in order with a known coverage of 57 and 55 percent. Eighty-six percent of the population of these two districts was white. District V is composed partly of good housing sections and partly of very poor ones, partly of white and partly of Negroes. Of the white population, which was 56 percent of the total, 48 percent were X-rayed. The response was best in the poorest sections in this district. In district IV, a slightly better white residential section, 42 percent were X-rayed. Together, these five districts,

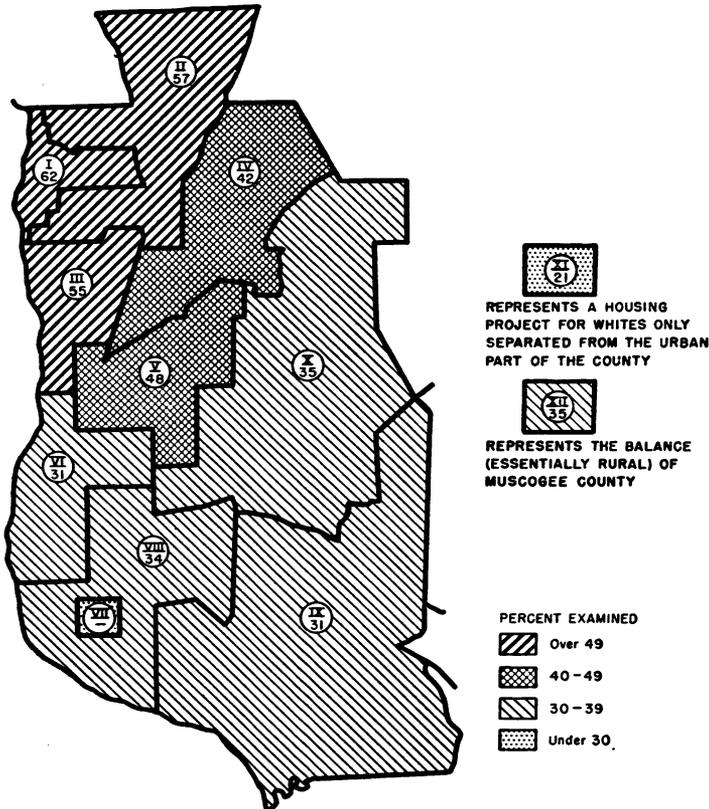


Figure 3. Percent of white population over 15 years of age examined in the survey shown by 12 districts; Muscogee County, Ga., 1946.

which rank as the first five in response to the survey, form the northern half of the city and include the densely populated areas directly north of the city. Many industries are located in this larger area.

About 4 miles southeast of the city, near Fort Benning, is a white housing project, district XI, occupied almost exclusively by army families. Thirteen percent of the white males were X-rayed and 29 percent of the white females. The poor response here may be because these families rely largely on army medical services. Districts VI and VIII, in the southern half of the city, near the main business center

are the oldest sections in Columbus, in which there are now many rooming houses with many temporary residents. The response in these two downtown districts was also poor—32 percent. Moreover, in the best residential areas, districts IX and X, only 34 percent were X-rayed. The remainder of the county which lies north, east and south of the city has been combined into district XII. In these more rural areas, 35 percent of the population was X-rayed. In every district except I and IV, a larger percent of the females were X-rayed than the males.

*Negro Population*

Table 4 and figure 4 are similar to the preceding ones in that they show the percent of the Negro population surveyed in the same 12 districts. The industrial X-rays do not play a significant part in the

**Table 4.** *Number and percent of Negro population over 15 years of age matched with survey records by district and by sex; Muscogee County, Ga., 1946*

District	Total			Male			Female		
	Population	Number matched	Percent matched	Population	Number matched with survey	Percent matched	Population	Number matched with survey	Percent matched
I.....	5	3	60				5	3	60
II.....	850	646	76	368	282	77	482	364	76
III.....	899	681	76	375	272	73	524	409	78
IV.....	488	339	69	215	153	71	273	186	68
V.....	3,575	2,491	70	1,485	1,061	71	2,090	1,430	68
VI.....	373	250	67	147	96	65	226	154	68
VII.....	1,332	1,069	80	535	434	81	797	635	80
VIII.....	6,121	4,260	70	2,536	1,755	69	3,585	2,505	70
IX.....	4,156	2,770	67	1,837	1,207	66	2,319	1,563	67
X.....	239	154	64	94	62	66	145	92	63
XI.....									
XII.....	2,717	1,884	69	1,324	937	71	1,393	947	68
Not stated.....				7	4		8	6	
Total.....	20,770	14,557	70	8,923	6,263	70	11,847	8,294	70

coverage of the Negro group—only 10 percent of the X-rays taken were obtained in the industrial stations, since few Negroes are employed in industry. The majority responded individually at public X-ray stations. There is less variation in the percent X-rayed by districts. Housing district VII ranks first with 80 percent known to have responded. Apart from this, districts with a high percent of whites X-rayed are usually districts in which a high percent of Negroes were X-rayed. The lowest coverage, 64 percent, was reached in district X, the best white residential area, where only 3 percent of the population was Negro. District IX, which contains a good white residential area, but which is 56 percent Negro, was the next lowest with 67 percent surveyed.

If all records, matched and unmatched, are used to determine the survey coverage in these 12 districts, the percent surveyed will be higher in every one. Moreover, the increase will be greater in those

districts in which the population has been described as less stationary because such areas produced relatively more unmatched records. District VI, with many homes converted into rooming houses and apartments, has the lowest percent, 61, of survey records matched for the white group. The highest percent matched, 92, is found in the best residential area, district X. The total number X-rayed in this district was increased but little by the addition of possible respondents for whom there was no census record. Therefore, if the Army housing

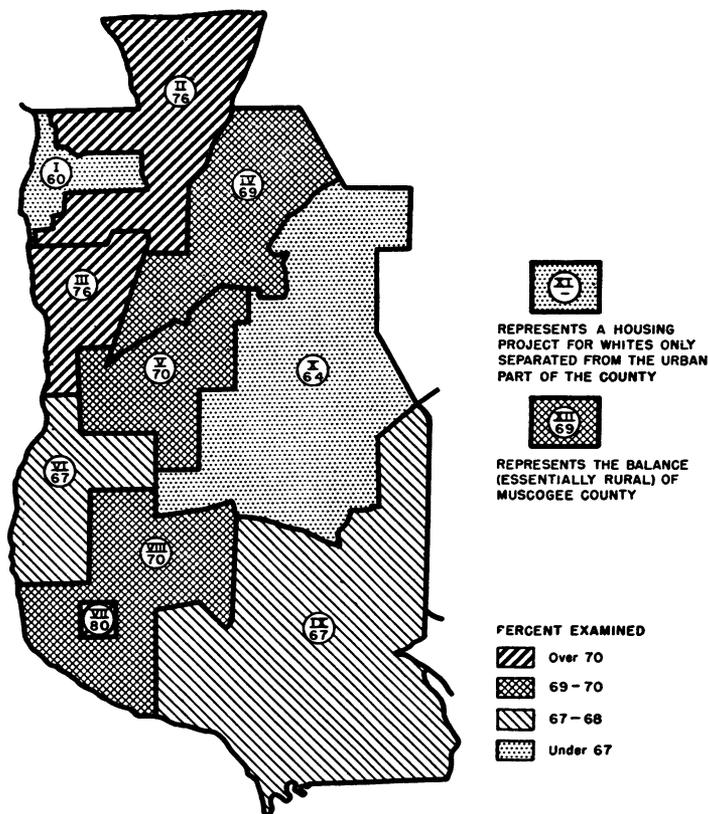


Figure 4. Percent of Negro population over 15 years of age examined in the survey shown by 12 districts; Muscogee County, Ga., 1946.

area is excluded, district X becomes the poorest in response when coverage is based on all survey records. District XII, the rural sections of the county, has a third of the survey records unmatched, probably because the use of the rural mail route as the only address on the X-ray record made the matching difficult and unsatisfactory.

Among the Negroes, the best matching was accomplished in the district made up of two housing projects where 88 percent were matched. In districts IV and X, both predominantly white, only 69 and 60 percent of the records for Negroes were matched. It may have

been that domestic servants used their employers' addresses on the survey record, but were enumerated at their own addresses, or employers may not have included in the household roster servants who have living quarters in the employer's home. The other nine districts showed little variation in the percentages of unmatched records.

**Census of Population**

**Muscogee County, Georgia, September 1946**

A—E. D. No.	B—Block No.	C—Schedule No.	D—Street and House No.
E—Enumerated by		F—Date completed ....., 1946.	G—Number of calls ----- 1 2 3 4 5

Line No.	NAME (last name first)	Relationship to head of household	Sex (M or F)	Color or Race (W, Neg. or Oth)	Age at last birth-day	Marital status (S, M, Wid, Div, Sep)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	-----	-----	-----	-----	-----	-----
2	-----	-----	-----	-----	-----	-----
3	-----	-----	-----	-----	-----	-----
4	-----	-----	-----	-----	-----	-----
5	-----	-----	-----	-----	-----	-----
6	-----	-----	-----	-----	-----	-----
7	-----	-----	-----	-----	-----	-----
8	-----	-----	-----	-----	-----	-----
9	-----	-----	-----	-----	-----	-----

<p>(8) FACILITIES OF PRESENT DWELLING UNIT:</p> <p>a. Flush toilet in the structure for exclusive use: Yes ----- No -----</p> <p>b. Installed bathtub or shower in the structure for exclusive use: Yes ----- No -----</p> <p>c. Running water in the unit: Yes ----- No -----</p> <p>d. Source of water supply: City ----- Other -----</p> <p>(9) TYPE OF UTILITIES:</p> <p>a. Electric lighting: Yes ----- No -----</p> <p>b. Heating -----</p> <p>c. Cooking -----</p>	<p>(10) NUMBER OF ROOMS.....</p> <p>(11) CONDITION OF PRESENT DWELLING UNIT:</p> <p>Good condition or needs minor repairs.....</p> <p>Needs major repairs.....</p> <p>Unfit for use.....</p> <p>(12) TENURE OF PRESENT DWELLING UNIT:</p> <p>Owned.....</p> <p>Rented.....</p> <p>(13) IF RENTED: What is the monthly contract rent? \$.....</p>
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Figure 5.

**Survey Response by Households**

The survey reached 89 percent of the Negro households and 63 percent of the white households enumerated in the 1946 census. If one person in a household is X-rayed, it seems reasonable to expect that other members of the family will be X-rayed since the importance

of the survey will have been emphasized to someone in that family. In other words, more families with no member X-rayed should be observed than would be expected on the basis of chance only. To test this assumption, the households enumerated in the census were tabulated by race, by the number of persons over 12 years of age in the household and by the number of these X-rayed.

The probability that a person would be X-rayed was determined by race for each size of household by dividing the number of persons X-rayed by the total number of persons in such households. The

Table 5. *Observed and expected number of households with all members examined or all members unexamined by size of household*

WHITE HOUSEHOLDS						
Size of household	Number of households	Probability of individual being X-rayed	Number of households with all members X-rayed		Number of households with no member X-rayed	
			Observed	Expected	Observed	Expected
1.....	914	0.426	389	389	525	525
2.....	9,104	.378	2,164	1,300	4,390	3,525
3.....	3,725	.463	707	370	980	577
4.....	2,377	.472	329	118	451	185
5.....	1,059	.482	107	28	146	40
6.....	444	.474	30	5	45	9
7.....	131	.433	4	0	9	2
8.....	74	.412	2	0	7	1
9 and over.....	124	.314	2	0	9	3
Total.....	17,952	-----	3,734	2,210	6,562	4,867

NEGRO HOUSEHOLDS						
Size of household	Number of households	Probability of individual being X-rayed	Number of households with all members X-rayed		Number of households with no member X-rayed	
			Observed	Expected	Observed	Expected
1.....	514	0.658	338	338	176	176
2.....	2,525	.710	1,446	1,275	383	212
3.....	1,684	.712	758	607	139	40
4.....	1,196	.708	436	300	53	9
5.....	602	.728	204	123	20	1
6.....	248	.704	63	30	9	0
7.....	115	.732	36	13	2	0
8.....	60	.669	9	2	0	0
9 and over.....	41	.650	5	1	0	0
Total.....	6,985	-----	3,295	2,689	782	438

probability of a white person's being X-rayed was lower in a two-person household than in a one or three-person household. After this, the probability increased with size of household to a peak in the five-person household. In households with more than six members the probabilities fall off, probably because roomers are often included in these larger units. In Negro households the probability of being X-rayed is lowest in the one-person household and highest in the seven-person. After the seven-person household the probabilities decrease.

Using these probabilities in the binomial expansion, the number of families in which no one would be expected to be X-rayed was computed for each size of family. On the basis of chance then, it was expected that there would be altogether 4,867 white families in which

no one would be expected to be X-rayed. Actually, 6,562 families failed to have even one member X-rayed. Likewise 438 Negro families would have no member X-rayed, but, in fact, there were 782 such families. It was also found that the proportion of families in which all of the adult members were examined was considerably higher than would be expected from a purely chance distribution of the X-rayed population. This suggests that if one person in a household accepts an X-ray examination, the likelihood of examining other members of that household is considerably increased.

### Radiographic Findings by Age, Race and Sex

#### 70 mm. Findings

Each person whose 70 mm. film was read as "tuberculosis (T)" or "suspected tuberculosis (S)" by either one of the two film readers, was recalled for a 14" x 17" film. In table 6 the X-rayed population, the number "recalled" as T or S, and the percent "recalled" are given by age, race and sex. Figure 6 shows these percentages in each age group by race and sex. The usually observed higher tuberculosis mortality in the Negro race is not reflected in the higher prevalence of

Table 6. Number and percent of X-rayed population recalled as "tuberculosis" or "suspected tuberculosis" on the 70-mm. film, by age, race, and sex; Muscogee County survey, 1946

Age	Total			White male		
	Number X-rayed	Number recalled	Percent recalled	Number X-rayed	Number recalled	Percent recalled
Total.....	51,940	1,871	3.6	13,601	612	4.5
Under 15 years.....	3,926	52	1.3	1,147	12	1.0
15-24.....	13,482	237	1.8	2,813	46	1.6
25-34.....	13,496	335	2.5	3,342	93	2.8
35-44.....	10,699	403	3.8	2,933	120	4.1
45-54.....	6,238	398	6.4	1,921	150	7.8
55-64.....	2,822	287	10.2	1,000	113	11.3
65-74.....	1,066	137	12.9	374	65	17.4
75 and over.....	181	22	12.2	65	13	20.0
Not stated.....	30			6		

Age	White female			Negro male			Negro female		
	Number X-rayed	Number recalled	Percent recalled	Number X-rayed	Number recalled	Percent recalled	Number X-rayed	Number recalled	Percent recalled
Total.....	16,711	611	3.7	10,062	314	3.1	11,566	334	2.9
Under 15 years.....	1,256	17	1.4	761	11	1.4	762	12	1.6
15-24.....	4,719	79	1.7	2,558	44	1.7	3,392	68	2.0
25-34.....	4,380	99	2.3	2,593	62	2.4	3,181	81	2.5
35-44.....	3,373	128	3.8	2,144	80	3.7	2,249	75	3.3
45-54.....	1,827	137	7.5	1,241	63	5.1	1,249	48	3.8
55-64.....	855	108	12.6	493	33	6.7	474	33	7.0
65-74.....	266	40	15.0	217	17	7.8	209	15	7.2
75 and over.....	28	3	10.7	49	4	8.2	39	2	5.1
Not stated.....	7			6			11		

suspicious 70 mm. films. Of the white persons X-rayed, 4 percent were recalled. Only 3 percent of the Negroes were recalled, however. Below the age of 25 the Negro recall rates are higher than the whites, though not significantly so, but above the age of 25 for males and 35 for females, the white rates are higher. In the older age groups there is a wide difference between the two races. Sixteen percent of the whites between 65 and 75 who were X-rayed were recalled; only 8 percent of the Negroes in the same age group were recalled. The higher mortality rates in the Negroes and the consequent removal of these cases from the Negro population in the early years of life may account for the lower prevalence of tuberculosis in the later ages.

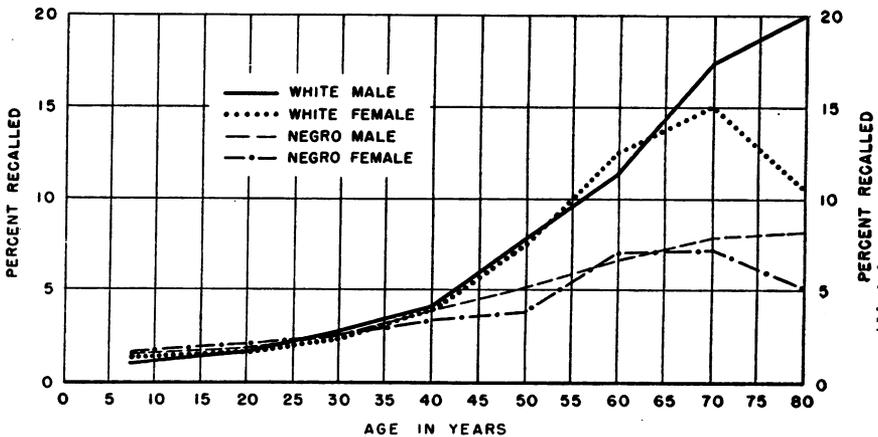


Figure 6. Percent of X-rayed population recalled as "tuberculosis" or "suspected tuberculosis" on 70-mm. film, by age, race, and sex; Muscogee County survey, 1946.

In both races the female recall rate for persons under 25 years of age is higher than the male. The Negro female rate continues to be higher than the male until age 35. After that, in both white and Negro, the male rates are higher with the exception of the 55-64 age group. However, in no age groups is the difference between the male and female rates statistically significant. The rise in the recall rates with age is probably due to the accumulation of infections through more years of life, and to the exposure to a higher prevalence of tuberculosis in preceding years (3).

The numbers in the recall group will, of course, depend on the reader, and in this survey the second reader increased the number recalled by 46 percent. However, the readings of the 70 mm. films by the two chest physicians on this study indicated that each reader recalled about the same percent of suspects—that is, the group read as negative by the first but suspect by the second corresponds in size to the group read as suspect by the first and negative by the second.

*14" x 17" Findings*

The "to be followed" group includes all those who, on the basis of the initial large films and a clinical history,<sup>6</sup> are to be followed regularly in the clinic. Here again the two readings of the 70 mm. films and the two readings of the 14" x 17" films have increased the number placed in this group. Figure 7 shows percentages and table 7 shows numbers and percentages from the X-rayed population forming the "to be followed" group by age, race and sex. The differences between the races follow the same general pattern as in the 70 mm. film "recall"

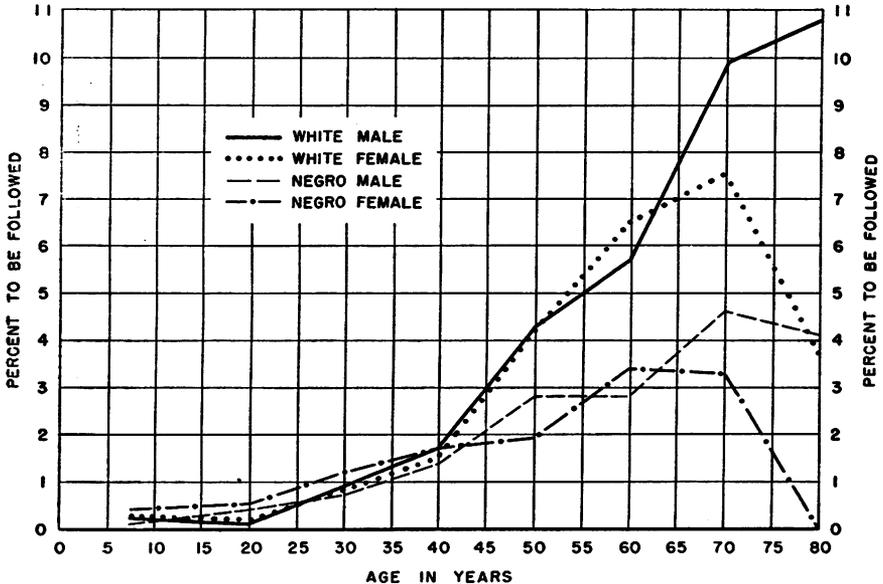


Figure 7. Percent of the X-rayed population to be followed as "tuberculosis" or "suspected tuberculosis" after clinical examination and a 14" x 17" film; Muscogee County survey, 1946.

groups. 1.7 percent of all whites X-rayed are "to be followed"; 1.2 percent of the Negroes are also "to be followed." In the 15-24 age group the difference between the white and Negro races in prevalence rates is statistically significant. In fact, in these years, over twice as many cases were found in the Negro population as in the white despite the fact that Negroes comprise only 44 percent of those X-rayed in this age group. Between 25 and 44 years of age there was little difference between the races. But after 45, the difference increased, the white "to be followed" rate becoming higher than the Negro. In the 65-74 age group 10 percent of the white males were to be followed and 8 percent of the white females were also included for follow-up. But only 5 percent of Negro males and 3 percent of Negro females in the same age group were in need of supervision.

<sup>6</sup> In many cases other forms of clinical, radiographic and laboratory examinations were also used.

Table 7. Number and percent of the X-rayed population to be followed as "tuberculosis" or "suspected tuberculosis" after clinical examination and a 14" x 17" film; Muscogee County survey, 1946

Age	Total			White male		
	Number X-rayed	Number to be followed	Percent to be followed	Number X-rayed	Number to be followed	Percent to be followed
Total.....	51,940	787	1.5	13,601	269	2.0
Under 15 years.....	3,926	11	0.3	1,147	3	0.3
15-24.....	13,482	37	.3	2,813	3	.1
25-34.....	13,496	123	.9	3,342	29	.9
35-44.....	10,699	172	1.6	2,933	51	1.7
45-54.....	6,238	217	3.5	1,921	82	4.3
55-64.....	2,822	143	5.1	1,000	57	5.7
65-74.....	1,066	74	6.9	374	37	9.9
75 and over.....	181	10	5.5	65	7	10.8
Not stated.....	30			6		

Age	White female			Negro male			Negro female		
	Number X-rayed	Number to be followed	Percent to be followed	Number X-rayed	Number to be followed	Percent to be followed	Number X-rayed	Number to be followed	Percent to be followed
Total.....	16,711	252	1.5	10,062	121	1.2	11,566	145	1.3
Under 15 years.....	1,256	4	0.3	761	1	0.1	762	3	0.4
15-24.....	4,719	8	.2	2,558	9	.4	3,392	17	.5
25-34.....	4,380	36	.8	2,593	19	.7	3,181	39	1.2
35-44.....	3,373	51	1.5	2,144	31	1.4	2,249	39	1.7
45-54.....	1,827	76	4.2	1,241	35	2.8	1,249	24	1.9
55-64.....	855	56	6.5	493	14	2.8	474	16	3.4
65-74.....	266	20	7.5	217	10	4.6	209	7	3.3
75 and over.....	28	1	3.6	49	2	4.1	39		
Not stated.....	7			6			11		

The differences between the percent of white males and females to be followed behave similarly to the sex differences revealed by 70 mm. findings. Of the white males, 2 percent were to be followed; 1.5 percent of the white females were to be followed. The differences in the age specific rates were not statistically significant. In the Negro population the female rate stays above the male rate until after 45 years of age, but differences between the age specific rates in the two sexes are likewise not statistically significant. For all ages the percents of males and females to be followed did not differ among the Negroes.

The proportion of the 70 mm. "recall" group which is to become the "to be followed" group after a 14" x 17" has been taken does not show a significant variation by race and sex. On the other hand, an extremely interesting variation by age was found. Table 8 shows that 49 percent of the total recalls were to be subsequently followed. Only 21 percent under 25 years remained in the follow-up group. Between 25 and 44 years, 47 percent were to be followed. Among persons 45 to 64 years of age 60 percent needed supervision and over 65 years, 63 percent were to be followed. It has been

suggested that this increase with age can perhaps be explained by the prominence of vascular markings in the upper lung fields in young adults which often cannot be easily differentiated from small infiltrates on the miniature film. It may also be speculated that in the older age groups the prevalence of generalized pulmonary fibrosis increases and this often cannot be readily distinguished from tuberculosis by radiographic examination.

**Table 8. Number and percent of "recalls" on 70 mm. film who are still to be followed as "tuberculosis" or "suspected tuberculosis" after initial 14" x 17" film, by age**

Age	Number recalled and re-X-rayed	Number to be followed	Percent to be followed
Total.....	1,603	787	49.1
Under 25.....	232	48	20.7
25-44.....	634	295	46.5
45-64.....	603	360	59.7
65 and over.....	134	84	62.7

The inclusion of suspects found by a second reader has the effect of lowering the proportion of recalls who will need follow-up. As might be expected, a film called T or S by both readers turned up in the "to be followed" group 2.5 times as often as a film called T or S by only one reader. Using two readers in this study has doubled the number in the "one reader only" positive groups, and consequently has weighted the recalls with those less likely to need follow-up.

Included in the diagnosed cases from the survey are cases of tuberculosis already known to the health department and cases previously diagnosed but not known to the health department. Of the total 787 cases or suspects in the "to be followed" group, 129 or 16 percent gave a history of a previous diagnosis of tuberculosis. Nineteen percent of the whites and 12 percent of the Negroes admitted a previous diagnosis had been made. An industrial survey in Columbus in 1943 had brought to light many of these cases.

After the first 14" x 17" film and clinical history were obtained, hospitalization was recommended for 50 patients, 6 percent of the group to be followed, one of the immediate values of a mass case finding program. In 28 instances, evidence of positive sputum was obtained at the time of the initial 14" x 17" film. Minimal cases comprised 80 percent of the diagnosed group and 57 percent of the total group was read as inactive on the first film. The minimal group particularly was increased by the second readings of both the 70 mm. and the 14" x 17" films.

#### *Comparison of Radiographic Findings in Industrial and Public Stations*

It has been suggested that among employed people, particularly those in industry, tuberculosis is more prevalent than among the general population (4). The X-ray stations in this survey were sepa-

rated into three groups—industrial, school, and public. The separation is not clear-cut, for some industrial workers were probably X-rayed in public stations because they had missed the industrial survey, belonged to a small nonsurveyed industry, or were not currently employed in factories. It seems reasonable to assume, however, that the group X-rayed in public stations is not preponderantly an industrially employed group.

There appears to be no difference in the percentage of whites recalled in industrial stations and in public stations. Of all white males, 4.7 percent were recalled in both. The rates of recall by age show no differences. The same statement is applicable to the "recalls" of white females; 3.8 percent were recalled in both groups.

Among Negroes, however, there were differences between those recalled from industrial and from public stations. Of the males X-rayed in public stations, 3.2 percent were recalled, but only 2.7 percent from industries. Of the Negro females X-rayed in public stations, 3 percent were recalled, but in industry, only 1 percent. However, only 10 percent of all Negroes were X-rayed in industrial stations. It may be that Negroes are more carefully selected for industrial employment because comparatively few are employed.

Since only 49 percent of the "recalls" were actually diagnosed as tuberculosis or suspected tuberculosis on a 14" x 17" film, comparison of prevalence as determined by the large film will be more useful. The total rates for white males were the same in both industrial and public groups (2.1 percent). The age specific rates are not significantly different except among those over 65 years for whom the industrial rate is the lower. The total rates for white females do not differ significantly, but the age specific rates, also not significantly different, are consistently higher in the industrial group. In public stations 1.6 percent were to be followed as compared with 1.7 percent in industries. The 14" x 17" findings for Negroes are lower in industries, than in public groups, following the pattern of the 70 mm. recalls. Of the Negro males X-rayed in public stations, 1.3 percent were to be followed as compared with 1 percent in industries. Of the Negro females X-rayed in public stations, 1.3 percent were to be followed, but in industries only 0.6 percent.

#### *Radiographic Findings by District*

Socioeconomic conditions appeared to be a factor in the survey coverage, for the response to the survey was better from the poorer districts. The next step is to determine the prevalence of tuberculosis in these twelve geographic districts of the county. Table 9 shows the percentage of the X-rayed over 15 years of age who were placed in the "to be followed" group, by district and by race. Figures 8 and 9 show the percentages by districts for white and Negro races.

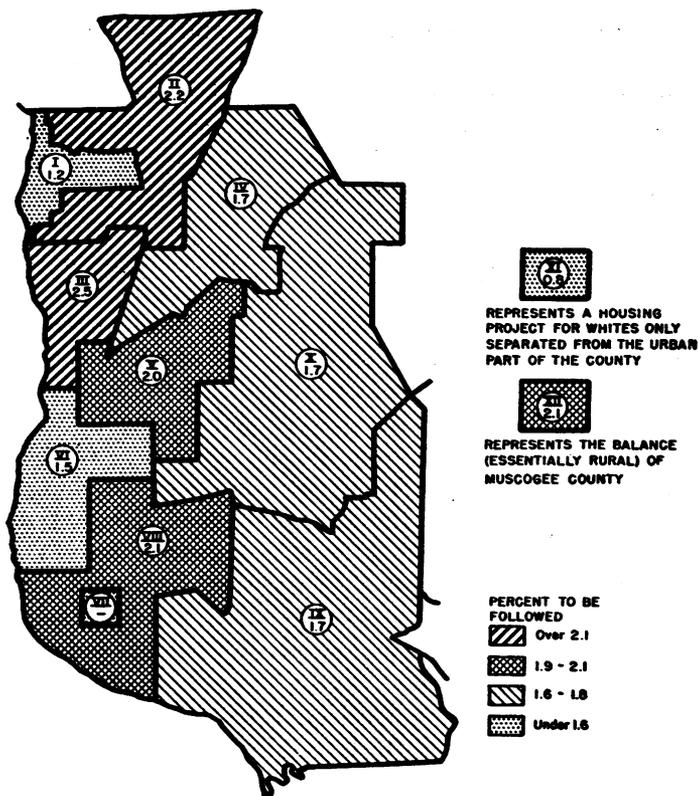


Figure 8. Percent of X-rayed white population over 15 years of age to be followed as "tuberculosis" or "suspected tuberculosis," shown by 12 districts; Muscogee County survey, 1946.

Among the white population in district I, the low rent industrial housing project where the largest percentage was X-rayed, only 1.2 percent are now being followed. Districts II and III, the next in order of X-ray coverage, are the poorest in housing conditions and are the highest two in prevalence of tuberculosis with 2.2 and 2.5 percent respectively, being placed in the "to be followed" group. District XII which is made up of rural sections of the county and district VIII had prevalence rates of 2.1 percent. Another mixed area, district V, with some substandard sections, had a rate of 2 percent and in this district, 48 percent were known to have been, X-rayed. Except for district XII and district VIII (2.1 percent) the districts with the smaller percentages X-rayed had prevalence rates under the mean of 1.9 percent. The Army housing project, district XI, had the best record since only 0.8 percent were in need of further follow-up, but this is probably explained by the fact that most of these people were young adults.

Among the Negroes there seems to be no relationship between the percent X-rayed in the district and the prevalence of tuberculosis as

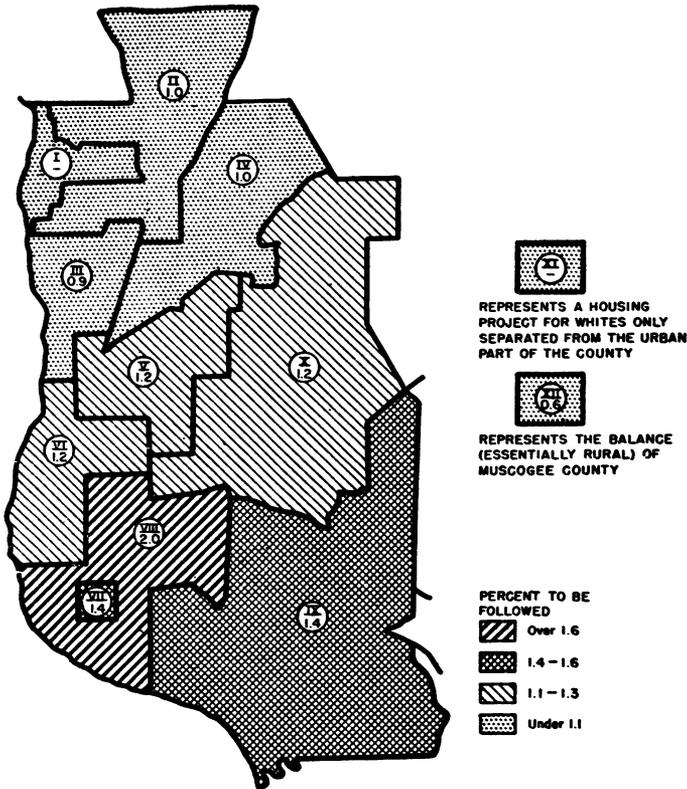


Figure 9. Percent of X-rayed Negro population over 15 years of age to be followed, shown by 12 districts; Muscogee County survey, 1946.

found among those X-rayed. In district VIII, which is probably one of the poorest Negro sections and where 29 percent of those X-rayed live, 2.0 percent are being followed. In the housing projects, district

Table 9. Number and percent of X-rayed population over 15 years of age to be followed as "tuberculosis" or "suspected tuberculosis" by district and race; Muscogee County survey, 1946

District	White			Negro		
	Number X-rayed	Number to be followed	Percent to be followed	Number X-rayed	Number to be followed	Percent to be followed
I.....	1,931	23	1.2	8		
II.....	3,837	83	2.2	778	8	1.0
III.....	3,243	80	2.5	794	7	0.9
IV.....	2,557	43	1.7	413	4	1.0
V.....	2,589	53	2.0	3,061	38	1.2
VI.....	2,004	30	1.5	324	4	1.2
VII.....				1,214	17	1.4
VIII.....	872	18	2.1	5,426	107	2.0
IX.....	1,225	21	1.7	3,502	49	1.4
X.....	2,602	43	1.7	255	3	1.2
XI.....	630	5	0.8			
XII.....	2,910	62	2.1	2,467	14	.6
Total.....	24,400	461	1.9	18,242	251	1.4

VII, the prevalence of tuberculosis is close to the mean prevalence of 1.4 percent. There appears to be the least tuberculosis among Negroes in district XII, the rural district in which only 0.6 percent of the surveyed are being followed.

*Estimated Prevalence of Tuberculosis in the Total Population*

The findings in the group X-rayed may or may not be representative of the entire county. Persons with previous diagnoses of tuberculosis may not feel it necessary to be X-rayed during a survey. Those who have had contact with tuberculosis and fear the disease may refuse to be X-rayed. These factors might indicate a higher prevalence among those not X-rayed. However, if there is more tuberculosis among those living under the poorest economic conditions but who responded to the survey better, then there may be less tuberculosis in the groups refusing X-rays. In this county it appears that among the whites there is less tuberculosis in the better economic sections and that these sections weight the non-X-rayed group more heavily. The age distributions of the X-rayed and the non-X-rayed differ, and since age specific rates differ, this may change the number of cases to be expected in the unexamined group. Assuming that there is no difference in the prevalence of tuberculosis in those X-rayed and those not X-rayed, an estimate has been made (table 10) of the number of cases which might be found in the total population if the rates by age, race and sex in the X-rayed group were applied to the total group. If the total population had been X-rayed and if the above assumption were correct, 2.3 times as many cases would now be followed among the whites and 1.3 times as many among the Negroes.

Table 10. *Estimate of the number of cases and suspects expected if the age, race, and sex rates for the X-rayed population are applicable to the total population*

Age	Total		White male		White female		Negro male		Negro female	
	To be followed group	Ex-pected group								
Under 15 years.....	11	73	3	24	4	28	1	5	3	16
15-24.....	33	40	3	4	6	12	8	8	16	16
25-34.....	110	174	22	59	34	58	18	18	36	39
35-44.....	161	233	47	86	47	75	28	29	39	43
45-54.....	191	328	69	129	69	135	34	35	20	29
55-64.....	124	276	44	100	52	135	12	16	16	25
65-74.....	72	212	34	89	20	90	10	17	8	16
75 and over.....	9	51	6	30	1	16	2	5		
Not stated.....										
Total.....	711	1,387	228	521	233	549	113	133	138	184

**Reasons for Refusing Survey Examination**

Emphasis has been placed on the practical advantages of carrying out community-wide X-ray surveys in a short period of time (5). For

groups working toward a 100 percent participation in a survey, it is of primary importance to know the best methods of securing the cooperation from the community and these methods may be influenced by a knowledge of why individuals or groups fail to be surveyed. Letters inviting non-X-rayed adults to have their chest X-rays at the health center were sent out after the census. Both the Venereal Disease Division of the Georgia State Health Department and the Public Health Service felt that this was an excellent opportunity to find out some of the reasons for poor response, and undertook to interview those who responded to the letters. It was expected that it would be difficult to persuade this group to be examined, since they had apparently resisted the publicity at the time of the survey. Of 35,000 persons to whom letters were mailed, about 3,000 responded for X-rays and 2,394 of these were interviewed. In addition, there were 472 interviews by telephone or field visit. Of the 2.3 percent recalled for large films on the basis of one reading, 66 percent were called "tuberculosis" or "suspected tuberculosis" on the large film by the same reader. The prevalence rate was 1.5 percent, slightly lower than the white survey rate when based upon the findings of two readers, but higher than the white survey rates when based on one reader only. The group to whom letters were sent was weighted with white persons since their response to the survey had been poorer.

The group responding to the letter is probably not representative of the unexamined group, since presumably they were the more cooperative. Altogether there were 2,866 people interviewed among whom 7 percent were not living in Columbus at the time of the survey. Of those who were in Columbus at that time, 14 percent claimed one year later that they had not known about the blood-testing and X-ray program, but nearly 85 percent stated that they were either out of town or in military service at the time of the survey.

There were 2,369 interviews sufficiently completed to allow tabulations of the answers. Many of the reasons people gave for not having an X-ray were not specific and might be called indifference, for 30-percent gave no suitable answer at all or only a statement of "too busy," 15 percent claimed to have been out of town, and 9 percent stated they were in military service at that time. Nineteen percent claimed to have had a recent examination and 7 percent said that they were under the care of a private physician. Eighty-five people or 3.6 percent thought they were too old to need an X-ray. Nine or 0.4 percent were known cases of tuberculosis who saw no need for going through survey procedures. Nine percent were in hospitals, or physically unable to leave home at that time. The reasons and the frequency with which they were given are listed in table 11 by race and sex.

Table 11. *Reasons given for failure to accept an X-ray during the survey*

Reason	Percent in each classification				
	Total	White male	White female	Negro male	Negro female
Total.....	<sup>1</sup> 2,369 100	<sup>1</sup> 846 100	<sup>1</sup> 933 100	<sup>1</sup> 247 100	<sup>1</sup> 343 100
Indifference.....	26	26	33	13	16
Out of town.....	15	13	15	15	20
Military service.....	9	18	.3	28	-----
Recent examination.....	19	23	14	21	19
Under private physician's care.....	7	2	11	2	12
Known tuberculosis case.....	.4	.4	.6	-----	-----
Tested in school.....	.7	.5	.6	.4	1.5
In jail.....	.4	.1	-----	2.4	3
Hospitalized or physically unable to leave home.....	9	4	11	6	17
Responsibility at home.....	1	.4	2	-----	.6
Inconvenient hours.....	3	4	3	2	.3
Travel difficulties.....	.6	.1	.9	.4	1.5
Too busy.....	4	5	4	2	3
Too long wait at survey station.....	.1	.1	.2	-----	-----
Overage.....	4	2	3	7	7
Underage.....	1	1	.9	1	.9
Religious belief.....	.1	-----	.3	-----	-----
Fear.....	.2	-----	.4	-----	-----

<sup>1</sup> Total number in group interviewed.

### Summary

1. Muscogee County, in west central Georgia, had a census population in September 1946, of 95,638, of which 28,706, or 30 percent, were Negroes. The only city in the county is Columbus with a population of 57,000. Neighboring areas include Phenix City, Ala., a part of metropolitan Columbus which had a population in 1948, of 22,187, and a large Army post, Fort Benning. The city of Columbus is highly industrialized.

2. A joint venereal disease-tuberculosis community-wide survey was conducted in May and June of 1946, in which 46,743 residents were X-rayed. Of the population over 15 years of age, 51 percent of the whites were examined and 89 percent of the Negroes. The response was poorest in the years from 20 through 34, and in the oldest age groups.

3. The response based only on survey records matched with census records varied among the whites by districts whose boundaries had been determined by geography and by similarities in housing conditions, rent, and proportion of white and Negro population. In the five districts forming the northern half of the city, which include the poorer white sections, the highest percent of the white population was covered. The percentages surveyed by district ranged from 62 to 21 percent. In the known survey coverage of the Negro population, there was much less variation by geographic district, from a high of 80 percent to a low of 64 percent. In all districts these percentages would have been raised if the total survey records had been used.

4. If one member of a family is surveyed, the probability of the remaining members being surveyed is increased. Likewise, the number of households with no persons X-rayed was greater than would be expected on the basis of chance distribution of the X-rayed population.

5. The prevalence rates of tuberculosis are somewhat higher than those reported for other communities in this area, partially because both small and large films were given a second reading. Two percent of the white males who had 70 mm. films were "to be followed" as cases of tuberculosis or suspected tuberculosis after a clinical examination which included a 14'' x 17'' film; 1.5 percent of white females, 1.2 percent of Negro males, and 1.3 percent of Negro females were also to be followed. The prevalence of tuberculosis increased with age. Between 15 and 24 years of age, there was more tuberculosis found in the Negro race than in the white. Little difference existed between the ages of 25 and 44, but after 45, the white and Negro rates moved farther apart. In the age group 65 through 74, 9 percent of whites were to be followed but only 4 percent of the Negroes.

6. In the poorest economic districts among the whites a higher percentage of the X-rayed are placed in the group to be followed as tuberculosis or suspected tuberculosis. The percentages to be followed by district range from 2.5 in a very poor section to 0.8 in an army housing project. In most of the districts with a low percent X-rayed the prevalence of tuberculosis was below the mean prevalence. Among the Negroes a poor section had the highest prevalence rate (2.0 percent) and the rural areas had the lowest prevalence (0.6 percent).

7. The proportion of 70 mm. recalls remaining in the group to be followed after a 14'' x 17'' film had been taken showed an interesting variation by age. It increased with age from 21 percent in those under 25 to 63 percent in those over 65 years of age.

8. Fifty cases were recommended for hospitalization at the time of the initial clinical examination. In 28 instances evidence of positive sputum was obtained at that time.

9. Eighty percent of all the diagnosed cases were minimal; 57 percent of the total were read as inactive. The percent of minimals was increased by a second reading of both the 70 mm. and 14'' x 17'' films. Sixteen percent of the cases had been previously diagnosed.

10. Among the white group there was little difference in the X-ray findings between those X-rayed in industrial stations and those X-rayed in public stations. But among the Negroes X-rayed in industry a smaller percentage was in need of follow-up. However, only 10 percent of the films of the Negro population were taken in industrial stations.

11. A sample of 2,866 persons who were not X-rayed during the

survey were questioned about their reasons for failing to be examined at that time. These reasons and the frequency of their occurrence have been listed for the benefit of those planning community-wide surveys.

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## A Comparison Between Histoplasmin and Blastomycin by the Collodion Agglutination Technique<sup>1</sup>

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Two distinctly different types of tests for the detection of antibodies in immune rabbit sera against *Histoplasma capsulatum* have been described in previous reports from this laboratory. In one, yeast phase antigens of *H. capsulatum* were employed in complement fixation studies (1, 2). In the other, antibodies against histoplasmin, a filtrate of the mycelial phase of *H. capsulatum*, were demonstrated by means of the collodion agglutination technique (3). The latter study showed that collodion particles sensitized with histoplasmin were agglutinated by specific sera but did not react with sera prepared against *Blastomyces braziliensis*, *Candida albicans*, *Sporotrichum schenckii*, or with normal rabbit sera. Weak or doubtful reactions, however, were obtained in low dilutions of sera prepared against *Blastomyces dermatitidis*. In the complement fixation studies, this cross reaction between *B. dermatitidis* and *H. capsulatum* was found to occur with the relationship more pronounced in the presence of blastomyces antigens than when histoplasma antigens were used.

The following experiments were therefore designed to determine (1) if, by means of the collodion agglutination test, a similar relationship could be shown to exist between histoplasmin and blastomycin, and

<sup>1</sup> From the Department of Bacteriology, Army Medical Department Research and Graduate School.

(2) if different lots of histoplasmin from various sources were equally applicable to the test. Five lots of histoplasmin in addition to the single lot (H-40) (3) which was employed in the first report were compared.

### Materials and Methods

The collodion particles used in this study were prepared according to the method of Cavelti (4). The test proper was conducted exactly as described in an earlier report (3). Optimal dilutions of the blastomycin and each of the various lots of histoplasmin were used to sensitize the collodion particles. Agglutinations were considered 4+ when the diameter of the flakes was 1 to 1½ mm. or more, with decreasing gradations of 3+ and 2+ being recorded with a corresponding decrease in the size of the particles and an increase in cloudiness of the suspending menstruum. The particles in a 1+ reaction were very fine but still readily visible. A test was considered doubtful (±) when particles were just barely visible and negative when no particulate matter was observed after resuspension. The immune rabbit sera were prepared as previously noted (1).

### Results

*Comparison of histoplasmin preparations.*—The optimal dilution of five lots of histoplasmin (H-17,<sup>2</sup> 37,<sup>2</sup> 38,<sup>2</sup> 39,<sup>2</sup> and AMS-1<sup>3</sup>) were determined by titration in the presence of immune rabbit sera and compared with that of the previously reported lot H-40<sup>2</sup> (3). All of the preparations sensitized collodion sufficiently to obtain clear-cut agglutinations. The optimal dilutions of the stock solutions of H-17, 37, 38, 39, and AMS-1 were found to be 1:300, 1:100, 1:100, 1:200 and 1:300, respectively, (table 1) while the optimal dilution of lot H-40, as in the previous report, was found to be 1:200. The titers of the same serum against the different lots was 1:160 except that in the presence of H-17 a 1:320 dilution of serum agglutinated the sensitized particles. The above results indicate that different lots of histoplasmin can be readily adapted to the collodion agglutination test by previous determination of the optimum dilution of each lot.

*Comparison of histoplasmin and blastomycin.*—As noted in table 2 reactions of homologous and heterologous sera were compared in the presence of collodion sensitized with optimal dilutions of histoplasmin (H-40) and blastomycin (B-7).<sup>2</sup> In part A, agglutination of histoplasmin-coated particles was noted with all histoplasma antisera (G-2, G-5, G-6) in varying titers, but no positive reactions were

<sup>2</sup> Kindly furnished by Dr. Arden Howell, Jr., Public Health Service, Duke University, Durham, N. C.

<sup>3</sup> Prepared at the Army Medical Department Research and Graduate School.

Table 1. Comparative optimal dilution determinations of different histoplasmin lots using serum prepared in rabbits against the G-2 strain of *H. capsulatum*

Lot No.	Dilution of histoplasmin <sup>1</sup> 0.5 ml.	Positive serum dilutions 0.5 ml.					Controls <sup>2</sup>	
		1:20	1:40	1:80	1:160	1:320	Antigen	Serum
H-17	1:100	1+	±	—	—	—	—	—
	1:200	3+	2+	1+	±	—	—	—
	1:300 <sup>3</sup>	4+	4+	4+	3+	1+	—	—
	1:400	4+	4+	4+	2+	1+	—	—
	1:500	4+	4+	4+	1+	1+	—	—
	1:600	4+	4+	3+	2+	±	—	—
	1:700	3+	2+	1+	—	—	—	—
	1:800	2+	1+	1+	—	—	—	—
H-37	1:25	3+	3+	2+	—	—	—	—
	1:50	3+	3+	2+	—	—	—	—
	1:100 <sup>3</sup>	4+	4+	4+	2+	—	—	—
	1:200	4+	2+	1+	—	—	—	—
	1:400	1+	1+	—	—	—	—	—
	1:800	1+	±	—	—	—	—	—
	1:50	4+	4+	3+	±	—	—	—
	1:100 <sup>3</sup>	4+	4+	4+	3+	±	—	—
H-38	1:200	4+	4+	3+	1+	—	—	—
	1:300	4+	4+	2+	1+	—	—	—
	1:400	3+	1+	1+	—	—	—	—
	1:800	±	—	—	—	—	—	—
	1:25	1+	±	—	—	—	—	—
	1:50	3+	1+	±	—	—	—	—
	1:100	3+	3+	1+	±	—	—	—
	1:200 <sup>3</sup>	4+	3+	3+	1+	—	—	—
H-39	1:300	4+	3+	1+	1+	—	—	—
	1:400	4+	2+	1+	—	—	—	—
	1:800	2+	1+	±	—	—	—	—
	AMS-1	1:10	1+	±	—	—	—	—
	1:100	2+	1+	—	—	—	—	—
	1:200	4+	1+	±	—	—	—	—
	1:300 <sup>3</sup>	4+	2+	2+	1+	—	—	—
	1:400	3+	2+	1+	±	—	—	—
1:500	2+	1+	—	—	—	—	—	
1:600	±	—	—	—	—	—	—	

<sup>1</sup> Dilution of histoplasmin before mixture with equal quantity of collodion with a turbidity equal to No. 2 McFarland nephelometer.

<sup>2</sup> In antigen control sensitized particles were mixed with 0.5 ml. of saline. In serum control positive serum (1:20) was mixed with unsensitized collodion. Normal rabbit serum was similarly titrated as above and was negative throughout.

<sup>3</sup> Optimal dilution.

obtained with the sera of rabbits immunized with *B. braziliensis*,<sup>4</sup> *C. neoformans*,<sup>4</sup> *C. albicans*,<sup>4</sup> *S. schenckii*,<sup>4</sup> or with normal rabbit sera. The sera of 2 (No. 13 and No. 19) of 4 rabbits immunized with the A-1 and A-5 strains of *B. dermatitidis* weakly agglutinated the particles in dilutions of 1:5 and 1:10. These observations were essentially in accord with those previously reported from this laboratory (3).

The results obtained in the presence of blastomycin-treated particles are recorded in part B of table 2. As noted in earlier studies, the antibody response to *B. dermatitidis* was weak with titers of only 1:5 to 1:10 being obtained with the specific sera of any of the 4 rabbits studied (Nos. 13, 14, 15, 19). In none of these did the agglutinations become stronger than 1+ or 2+. By contrast, blastomycin-treated particles with histoplasma antisera gave positive reactions in dilutions varying from 1:5 to 1:80, many of which were of 4+ intensity. These

<sup>4</sup> Since there are no standardized products from these organisms similar to histoplasmin, determinations of specific titers in terms of collodion agglutination tests were not possible. However, these sera were shown to contain antibodies by means of the complement fixation test with *S. schenckii*, *C. albicans*, *B. braziliensis* and *C. neoformans* exhibiting titers of 1:320, 1:40, 1:80 and 1:10, respectively.

titers, however, were usually less than those observed in the specific reaction between histoplasmin and histoplasma antisera (compare A and B in table 2). None of the other fungal antisera agglutinated the particles in the presence of blastomycin with the exception of a 1+ reaction with a 1:5 dilution of serum from rabbit No. 20 immunized with *S. schenckii*.

Table 2. Comparative results of collodion agglutination test with rabbit sera in the presence of histoplasmin and blastomycin

Sera	Rabbit No.	A Collodion plus histoplasmin (H-40) Serum dilutions—0.5 ml.						B Collodion plus blastomycin B-7) Serum dilutions—0.5 ml.						
		1:5	1:10	1:20	1:40	1:80	1:160	1:320	1:5	1:10	1:20	1:40	1:80	1:160
		G-2 <i>H. capsulatum</i> .....	1	4+	4+	4+	3+	3+	2+	—	4+	4+	4+	3+
Do.....	3	2+	±	—	—	—	—	—	1+	—	—	—	—	—
Do.....	4	2+	1+	1+	—	—	—	—	2+	—	—	—	—	—
G-5 <i>H. capsulatum</i> .....	6	4+	4+	3+	3+	1+	—	—	4+	4+	2+	—	—	—
G-6 <i>H. capsulatum</i> .....	9	2+	1+	—	—	—	—	—	2+	1+	±	—	—	—
A-1 <i>B. dermatitidis</i> .....	13	1+	±	—	—	—	—	—	1+	1+	±	—	—	—
Do.....	14	—	—	—	—	—	—	—	1+	1+	±	—	—	—
A-5 <i>B. dermatitidis</i> .....	15	—	—	—	—	—	—	—	1+	±	—	—	—	—
Do.....	19	1+	1+	±	—	—	—	—	2+	1+	—	—	—	—
B-3 <i>B. braziliensis</i> .....	17	—	—	—	—	—	—	—	—	—	—	—	—	—
Do.....	18	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>C. neoformans</i> .....	26	—	—	—	—	—	—	—	—	—	—	—	—	—
<i>S. schenckii</i> .....	19	±	—	—	—	—	—	—	—	—	—	—	—	—
Do.....	20	±	—	—	—	—	—	—	—	—	—	—	—	—
<i>C. albicans</i> .....	22	—	—	—	—	—	—	—	—	—	—	—	—	—
Do.....	23	—	—	—	—	—	—	—	—	—	—	—	—	—
Normal rabbit sera.....	—	—	—	—	—	—	—	—	—	—	—	—	—	—

## Discussion

The data presented here demonstrate that different lots of histoplasmin may be readily adapted to the collodion agglutination test by the previous determination of optimal dilutions. Six different lots of stock histoplasmin have been shown to yield comparable results in the presence of specific immune serum. Blastomycin, which like histoplasmin is a filtrate of the mycelial phase of the organism, can also be adapted to the collodion agglutination technique. Whereas histoplasma antiserum caused strong agglutination of histoplasmin-sensitized particles, blastomyces antisera only weakly agglutinated collodion treated with blastomycin. The comparatively low potency of blastomyces antisera has been previously noted in complement fixation studies from this laboratory and has been attributed to the apparently weaker immunogenic capacity of *B. dermatitidis*.

This factor was further brought out when homologous and heterologous sera were allowed to react with collodion sensitized with either histoplasmin or blastomycin. In the presence of histoplasmin, specific sera more readily agglutinated the collodion while blastomyces antisera caused agglutination in 2 of 4 cases and then only weakly in low titer. On the other hand, histoplasma antisera strongly agglutinated collodion particles sensitized with blastomycin and, al-

though usually not in as high dilution as when histoplasmin was used as antigen, in higher titer than the apparently weak specific blastomycetes antisera.

This observation is in accord with our previous studies with yeast phase antigens in complement fixation wherein higher titers against *B. dermatitidis* antigens were obtained with *H. capsulatum* sera than with specific sera. Such cross reactions have been previously discussed and again suggest the value of using both *H. capsulatum* and *B. dermatitidis* antigens in evaluating antibody responses to either of these agents. In this way a more comprehensive and critical evaluation of the test proper and of the derived results may be obtained.

### Summary

1. Collodion particles sensitized with either histoplasmin or blastomycin were employed in agglutination studies. Specific histoplasma rabbit sera strongly agglutinated collodion suspensions sensitized with histoplasmin and also reacted with blastomycin-treated particles to a lesser degree.

2. *B. dermatitidis* antisera reacted in low dilutions with blastomycin-coated particles and gave weaker or negative agglutination reactions when histoplasmin was used as antigen.

3. Rabbit sera prepared against *B. braziliensis*, *S. schenckii*, *C. neoformans*, and *C. albicans* as well as normal sera did not, as a rule, agglutinate collodion particles sensitized with either histoplasmin or blastomycin.

4. Six different lots of histoplasmin were compared and found applicable to the collodion agglutination test.

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- (1) Saslaw, Samuel, and Campbell, Charlotte C.: The use of yeast phase antigens in a complement fixation test for histoplasmosis. I. Preliminary results with rabbit sera. *J. Lab. and Clin. Med.* **33**: 811-818 (1948).
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- (3) Saslaw, Samuel and Campbell, Charlotte C.: A method for demonstrating antibodies in rabbit sera against histoplasmin by the collodion agglutination technic. *Proc. Soc. Exper. Biol. and Med.* **68**: 559-562 (1948).
- (4) Cavelti, Philip A.: The technic of collodion particle agglutination. *J. Immunol.* **57**: 141-154 (1947).

# INCIDENCE OF DISEASE

*No health department, State or local, can effectively prevent or control disease without knowledge of when, where and under what conditions cases are occurring*

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## UNITED STATES

### REPORTS FROM STATES FOR WEEK ENDED FEBRUARY 12, 1949

A seasonal increase was recorded in the incidence of measles of 2,637 cases (15 percent, from a total of 17,685 last week to 20,322 currently), as compared with an increase of 4,572 cases (24.5 percent, from 18,648 to 23,220) reported for the corresponding week in 1944, the latter figure being the largest corresponding figure of the past 5 years. The 5-year (1944-48) median is 11,260. Currently, increases were recorded in all of the 9 geographic divisions except the Mountain area. Of 16 States reporting more than 500 cases each, 8 reporting more than 700 each are as follows (last week's figures in parentheses): Maine 753 (486), Massachusetts 1,308 (1,391), New York 1,385 (1,315), Pennsylvania 1,422 (1,402), Maryland 1,195 (1,127), Virginia 861 (827), Texas 3,020 (2,456), and California 1,248 (655). The total reported to date this year is 89,615, corresponding period in 1944, 91,719 (highest of the past 5 years), 5-year median, 39,542.

A slight decline in the incidence of influenza was reported. The total for the week is 4,905, last week 5,170, 5-year median 8,846. The 4 States reporting more than 177 cases each are Virginia 431 (last week 437), South Carolina 652 (last week 663), Arkansas 294 (last week 155), Texas 2,612 (2,794). The total for the year to date is 27,416, same period last year (also the 5-year median) is 71,949.

Of 62 cases of poliomyelitis reported (last week 80, 5-year median 32), 16 occurred in California, 7 in Washington, and 4 each in New York and Idaho.

During the week 2 cases of anthrax were reported, in New York. Of 4 cases of smallpox, 2 occurred in Missouri and 1 each in South Dakota and Kansas.

Deaths recorded during the week in 94 large cities in the United States totaled 10,057, as compared with 9,838 last week, 10,071 and 10,053, respectively, for the corresponding weeks of 1948 and 1947 and a 3-year (1946-48) medium of 10,071. The total for the year to date is 60,009, as compared with 63,203 for the corresponding period last year. Infant deaths recorded for the week totaled 672, last week 734, 3-year median 670. The cumulative figure is 4,151, same period last year 4,345.

Telegraphic case reports from State health officers for week ended Feb. 12, 1949

[Leaders indicate that no cases were reported]

Division and State	Diphtheria	Encephalitis, infectious	Influenza	Measles	Meningitis, meningococcal	Pneumonia	Polio-myelitis	Rocky Mt. spotted fever	Scarlet fever	Smallpox	Tularia	Typhoid and paratyphoid fever <sup>a</sup>	Whooping cough	Rabies in animals
<b>NEW ENGLAND</b>														
Maine.....	3			753		18			12				5	
New Hampshire.....				37		4			4					
Vermont.....				408		1			3				3	
Massachusetts.....	9	1		1,308	2				328				71	
Rhode Island.....				193		8			11			1	4	
Connecticut.....	2		26	372	2	66			52				3	
<b>MIDDLE ATLANTIC</b>														
New York.....	8	2	<sup>b</sup> 1	1,385	4	355	4		<sup>a</sup> 269			1	126	4
New Jersey.....	4		1	467	1	70	2		138				36	1
Pennsylvania.....	6		(b)	1,422	3		1					3	92	
<b>EAST NORTH CENTRAL</b>														
Ohio.....	3		3	75	5	42	1		354			4	62	22
Indiana.....	3	1	5	84	2	37			91				21	17
Illinois.....	2	1	6	58	8	88	2		189				29	5
Michigan <sup>d</sup> .....	4		10	512	5	43			353			5	46	5
Wisconsin.....			77	698	7	11			78			2	57	
<b>WEST NORTH CENTRAL</b>														
Minnesota.....	4			100		6	2		74				2	
Iowa.....			2	42	1	3	1		48				5	8
Missouri.....			9	556		28			34	2	3	3	7	
North Dakota.....			2	66					10				9	
South Dakota.....				11		2			<sup>a</sup> 3	1			2	
Nebraska.....			10	33		10	1		16					
Kansas.....	2			607		20			21	1	2		7	
<b>SOUTH ATLANTIC</b>														
Delaware.....	1			19					9				1	
Maryland <sup>d</sup> .....	7		6	1,195	1	74	2		<sup>a</sup> 38			2	6	
District of Columbia.....	3		1	40		15			10				10	
Virginia.....	1		431	861	3	147	2		38		1		40	1
West Virginia.....	2		35	270		6			23				13	
North Carolina.....	2			353	4		2		21		2	4	30	

South Carolina.....	6		652	86	1	190	1		7			21	1	
Georgia.....	6		22	315	4	28	2		6		6	4	10	
Florida.....	9		9	109		20	3		3		1	11	3	
<b>EAST SOUTH CENTRAL</b>														
Kentucky.....	12	1	59	504	5	57			88		1	1	57	17
Tennessee.....	6		63	186	4	124	1		41		1	2	19	
Alabama.....	8		125	646	2	104			12			1	5	10
Mississippi <sup>d</sup> .....	5	1	26	55		53			6		1	1	1	
<b>WEST SOUTH CENTRAL</b>														
Arkansas.....	9		294	300		126	3		4				11	
Louisiana.....			3	90		26			5		2	2	1	1
Oklahoma.....	1		71	289		44	2		26		1		4	1
Texas.....	23		2,612	3,020	12	683	2		61		3	1	179	22
<b>MOUNTAIN</b>														
Montana.....			7	42	1	1			21		1	1		
Idaho.....	3	1	11	40		12	4		24			2		
Wyoming.....				13		1			11					
Colorado.....	3		48	172		58			30				13	
New Mexico.....	1		1	108		16			28					
Arizona.....	7		177	133		45	3		5		1	1	13	
Utah <sup>d</sup> .....	2			97		2			3				6	
Nevada.....				1					2					
<b>PACIFIC</b>														
Washington.....			37	434	1	5	7		66					
Oregon.....	1		28	500		33	1		10				17	
California.....	18		35	1,248	7	64	16		85			3	72	8
<b>Total</b> .....	<b>186</b>	<b>8</b>	<b>4,905</b>	<b>20,322</b>	<b>85</b>	<b>2,736</b>	<b>62</b>		<b>2,771</b>	<b>4</b>	<b>27</b>	<b>41</b>	<b>1,121</b>	
<b>Median, 1944-48</b> .....	<b>299</b>	<b>8</b>	<b>8,846</b>	<b>11,260</b>	<b>175</b>		<b>32</b>		<b>3,324</b>	<b>4</b>	<b>14</b>	<b>48</b>	<b>1,922</b>	
<b>Year to date 6 weeks</b> .....	<b>1,121</b>	<b>48</b>	<b>27,416</b>	<b>89,615</b>	<b>520</b>	<b>13,733</b>	<b>1,635</b>	<b>8</b>	<b>15,977</b>	<b>6</b>	<b>202</b>	<b>237</b>	<b>6,493</b>	
<b>Median, 1944-48</b> .....	<b>1,878</b>	<b>44</b>	<b>71,949</b>	<b>39,542</b>	<b>1,295</b>		<b>246</b>	<b>1</b>	<b>17,479</b>	<b>39</b>	<b>136</b>	<b>254</b>	<b>13,648</b>	
	(27th)		(30th)	(35th)	(37th)		(11th)		(32d)	(35th)		(11th)	(39th)	
<b>Seasonal low week ends</b> .....	<b>July 10</b>		<b>July 31</b>	<b>Sept. 4</b>	<b>Sept. 18</b>		<b>Mar. 20</b>		<b>Aug. 14</b>	<b>Sept. 4</b>		<b>Mar. 20</b>	<b>Oct. 2</b>	
<b>Since seasonal low week</b> .....	<b>6,235</b>		<b>63,686</b>	<b>142,008</b>	<b>1,364</b>		<b>127,962</b>		<b>38,675</b>	<b>21</b>		<b>3,356</b>	<b>16,526</b>	
<b>Median, 1943-48</b> .....	<b>9,444</b>		<b>115,507</b>	<b>65,666</b>	<b>2,799</b>		<b>13,617</b>		<b>56,050</b>	<b>115</b>		<b>4,490</b>	<b>39,065</b>	

\* Including paratyphoid fever, reported separately, as follows: New York 1; Wisconsin 1; North Carolina 1; California 1; salmonella infections, not included, were reported as follows: Massachusetts 2; New York 1; Pennsylvania 1.

<sup>b</sup> New York City and Philadelphia only, respectively.

<sup>c</sup> Including cases reported as streptococcal infection and septic sore throat.

<sup>d</sup> Period ended earlier than Saturday.

Anthrax: New York 2.

Smallpox: Missouri 2; South Dakota 1; Kansas 1.

<sup>1</sup> Correction: North Carolina, poliomyelitis, week ended January 22, 1 case (instead of 2).

Alaska: Influenza 95; measles 3; scarlet fever 1; streptococcus throat 3.

Territory of Hawaii: Influenza 23; measles 269; poliomyelitis 1; whooping cough 1.

**PLAGUE INFECTION IN YAKIMA COUNTY, WASH.**

Under date of February 7, plague infection was reported proved in a pool of 64 fleas from 53 short-tailed meadow mice, *Lagurus curtatus*, trapped January 20, 1949, on the U. S. Army firing range 10 miles northeast of Yakima, Yakima County, Wash.

**DEATHS DURING WEEK ENDED FEB. 5, 1949**

[From the Weekly Mortality Index, issued by the National Office of Vital Statistics]

	Week ended Feb. 5, 1949	Correspond- ing week, 1948
<b>Data for 94 large cities of the United States:</b>		
Total deaths.....	9,838	10,772
Median for 3 prior years.....	10,259	-----
Total deaths, first 5 weeks of year.....	49,952	53,132
Deaths under 1 year of age.....	734	754
Median for 3 prior years.....	751	-----
Deaths under 1 year of age, first 5 weeks of year.....	3,479	3,667
<b>Data from industrial insurance companies:</b>		
Policies in force.....	70,633,498	66,886,217
Number of death claims.....	14,328	14,027
Death claims per 1,000 policies in force, annual rate.....	10.6	11.0
Death claims per 1,000 policies, first 5 weeks of year, annual rate.....	9.8	11.2

## FOREIGN REPORTS

### CANADA

*Provinces—Communicable diseases—Weeks ended January 22 and 29, 1949.*—During the weeks ended January 22 and 29, 1949, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

*Week ended Jan. 22, 1949*

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox.....		110		230	873	58	77	133	346	1,827
Diphtheria.....				31	1	1		3		36
German measles.....				50	21		5	9	5	90
Influenza.....		27				3				38
Measles.....		190	3	175	311	169	95	230	141	1,314
Meningitis, meningococcal.....					1			1		2
Mumps.....		18		143	178	44	31	52	119	585
Poliomyelitis.....		1		2		1				6
Scarlet fever.....		8		167	78	6	2	8	13	282
Tuberculosis (all forms).....		15	3	104	35	8	8		28	201
Typhoid and paratyphoid fever.....				7				1	3	11
Undulant fever.....				2						2
Veneral diseases:										
Gonorrhoea.....	1	18	9	99	51	23	12	38	124	375
Syphilis.....	1	10	18	87	48	11	12	6	12	205
Whooping cough.....		2		185	33	4			11	252

*Week ended Jan. 29, 1949*

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox.....		70	3	343	752	39	80	139	356	1,782
Diphtheria.....				25	5	1		16	1	48
Dysentery, bacillary.....				1			1			2
German measles.....		1		77	24	4		15	12	133
Influenza.....		16			4	2			1	23
Measles.....		368	9	300	249	124	96	240	115	1,501
Meningitis, meningococcal.....						3				3
Mumps.....		42	2	72	322	39	24	36	97	634
Poliomyelitis.....				1					1	2
Scarlet fever.....		8	1	170	81	1	3	15	10	289
Tuberculosis (all forms).....		6	9	100	22	13	7	21	31	209
Typhoid and paratyphoid fever.....				19	2				1	22
Undulant fever.....				3						3
Veneral diseases:										
Gonorrhoea.....		11	13	100	59	21	23	37	97	361
Syphilis.....		16	15	87	37	9	2	4	19	189
Whooping cough.....				156	22	1	11	2		192

## JAMAICA

*Notifiable diseases—4 weeks ended January 29, 1949.*—For the 4 weeks ended January 29, 1949, cases of certain notifiable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Chickenpox.....	1	7	Leprosy.....	—	3
Diphtheria.....	2	5	Tuberculosis (pulmonary).....	36	50
Erysipelas.....	1	1	Typhoid fever.....	4	66

## NEW ZEALAND

*Notifiable diseases—5 weeks ended December 31, 1948.*—During the 5 weeks ended December 31, 1948, certain notifiable diseases were reported in New Zealand, as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Cerebrospinal meningitis.....	11	1	Malaria.....	1	—
Diphtheria.....	15	—	Ophthalmia neonatorum.....	1	—
Dysentery:			Poliomyelitis.....	99	6
Amebic.....	2	—	Puerperal fever.....	4	—
Bacillary.....	2	—	Scarlet fever.....	86	2
Encephalitis, lethargic.....	1	—	Tetanus.....	2	2
Erysipelas.....	14	—	Tuberculosis (all forms).....	176	49
Food poisoning.....	9	—	Typhoid fever.....	7	1
Influenza.....	1	1	Undulant fever.....	3	—

## NORWAY

*Notifiable diseases—November 1948.*—During the month of November 1948, cases of certain notifiable diseases were reported in Norway as follows:

Disease	Cases	Disease	Cases
Cerebrospinal meningitis.....	13	Mumps.....	521
Diphtheria.....	65	Paratyphoid fever.....	2
Dysentery, unspecified.....	2	Pneumonia (all forms).....	2,440
Erysipelas.....	413	Poliomyelitis.....	24
Gastroenteritis.....	2,311	Rheumatic fever.....	106
Gonorrhoea.....	387	Scabies.....	3,110
Hepatitis, epidemic.....	145	Scarlet fever.....	729
Impetigo contagiosa.....	3,323	Syphilis.....	102
Influenza.....	6,115	Tuberculosis (all forms).....	402
Laryngitis.....	11,865	Well's disease.....	1
Malaria.....	2	Whooping cough.....	873
Measles.....	2,909		

## REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

*Note.*—The following reports include only items of unusual incidence or of special interest and the occurrence of these diseases, except yellow fever, in localities which had not recently reported cases. All reports of yellow fever are published currently.

A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

### Cholera

*India—Calcutta.*—During the week ended January 22, 1949, 219 cases of cholera with 68 deaths were reported in Calcutta, India, and during the week ended January 29, 1949, 169 cases with 59 deaths were reported.

### Plague

*Brazil.*—For the period August 1–31, 1948, 99 cases of plague with 10 deaths were reported in Brazil. The total for the year to August 31, 1948, is 224 cases, 35 deaths.

*India—Cawnpore.*—During the week ended January 29, 1949, 8 cases of plague with 3 deaths were reported in Cawnpore, India.

*Union of South Africa—Orange Free State.*—During the week ended January 29, 1949, 1 fatal suspected case of bubonic plague was reported at Ellingham Farm, Koppies District, Orange Free State, Union of South Africa.

### Smallpox

*Bahrein Islands.*—For the week ended January 29, 1949, 7 cases of smallpox were reported in Bahrein Islands.

*Brazil.*—For the period August 1–31, 1948, 117 cases of smallpox with 3 deaths were reported in Brazil, including 31 cases, 2 deaths, in Rio de Janeiro, 10 cases in Sao Luiz, and 8 cases in Salvador.

*China—Amoy.*—For the period January 11–20, 1949, 19 cases of smallpox were reported in Amoy, China.

*Dahomey.*—During the period January 21–31, 1949, 61 cases of smallpox with 7 deaths were reported in Dahomey, French West Africa.

*Ecuador.*—During the months September–November, 1948, an outbreak of smallpox was reported in Loja Province, Ecuador. Cases and deaths reported during the period are as follows: September 1–30, 1948, 303 cases, 20 deaths; October 1–31, 261 cases, 19 deaths; November 1–30, 112 cases, 11 deaths.

*India—Ahmedabad.*—Smallpox has been reported in Ahmedabad, India, as follows: Week ended January 15, 1949, 119 cases, 60 deaths; week ended January 22, 125 cases, 59 deaths.

*Indochina (French)*—*Laos State—Luang-Prabang Province.*—Smallpox has been reported in Luang-Prabang Province, Laos State, French Indochina, as follows: Week ended January 22, 1949, 464 cases, 232 deaths; week ended January 29, 86 cases, 41 deaths.

*Korea.*—For the period January 1–15, 1949, 135 cases of smallpox were reported in Korea, including 30 cases in Seoul.

#### **Typhus Fever**

*Chile.*—During the period August 15–September 11, 1948, 213 cases of typhus fever with 28 deaths were reported in Chile, including 6 cases 1 death in Antofagasta, 5 cases in Santiago, and 1 case in Talcahuano.

*Korea.*—During the period January 1–15, 1949, 23 cases of typhus fever were reported in Korea, including 1 case in Seoul.

*Peru.*—Typhus fever has been reported in Peru as follows: August 1–31, 1948, 235 cases; September 1–30, 223 cases.

#### **Yellow Fever**

*Belgian Congo—Stanleyville Province.*—During the period January 17–24, 1949, 1 fatal case of yellow fever was reported in the Paulis area in Stanleyville Province, Belgian Congo.

### **International Validity Periods For Immunization Certificates**

The World Health Organization has advised member nations that certificates of immunization against cholera, smallpox and yellow fever are to be valid for the following periods:

<i>Certificate</i>	<i>Period of validity, reckoned from the date of immunization</i>
Cholera inoculation.....	7 days to 6 months
Smallpox vaccination.....	14 days to 3 years
Yellow fever inoculation.....	10 days* to 4 years

\*Except in the case of persons reinoculated within 4 years.

These standards were set by the Quarantine Section of the World Health Organization's Expert Committee on International Epidemiology and Quarantine at its meeting in Geneva, Switzerland, November 18, 1948. They were adopted to clarify provisions of the International Sanitary Conventions of 1944.

The health authorities of the signatory nations are urgently requested to adhere to these periods to prevent confusion and administrative difficulties in connection with international travel.